

TECHNOLOGY DEPT:

A PICTORIAL SURVEY OF CURRENT PRACTICE, EQUIPMENT AND MATERIALS

Construction Methods

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RURAL ELECTRIFICATION

A discussion of construction methods and equipment

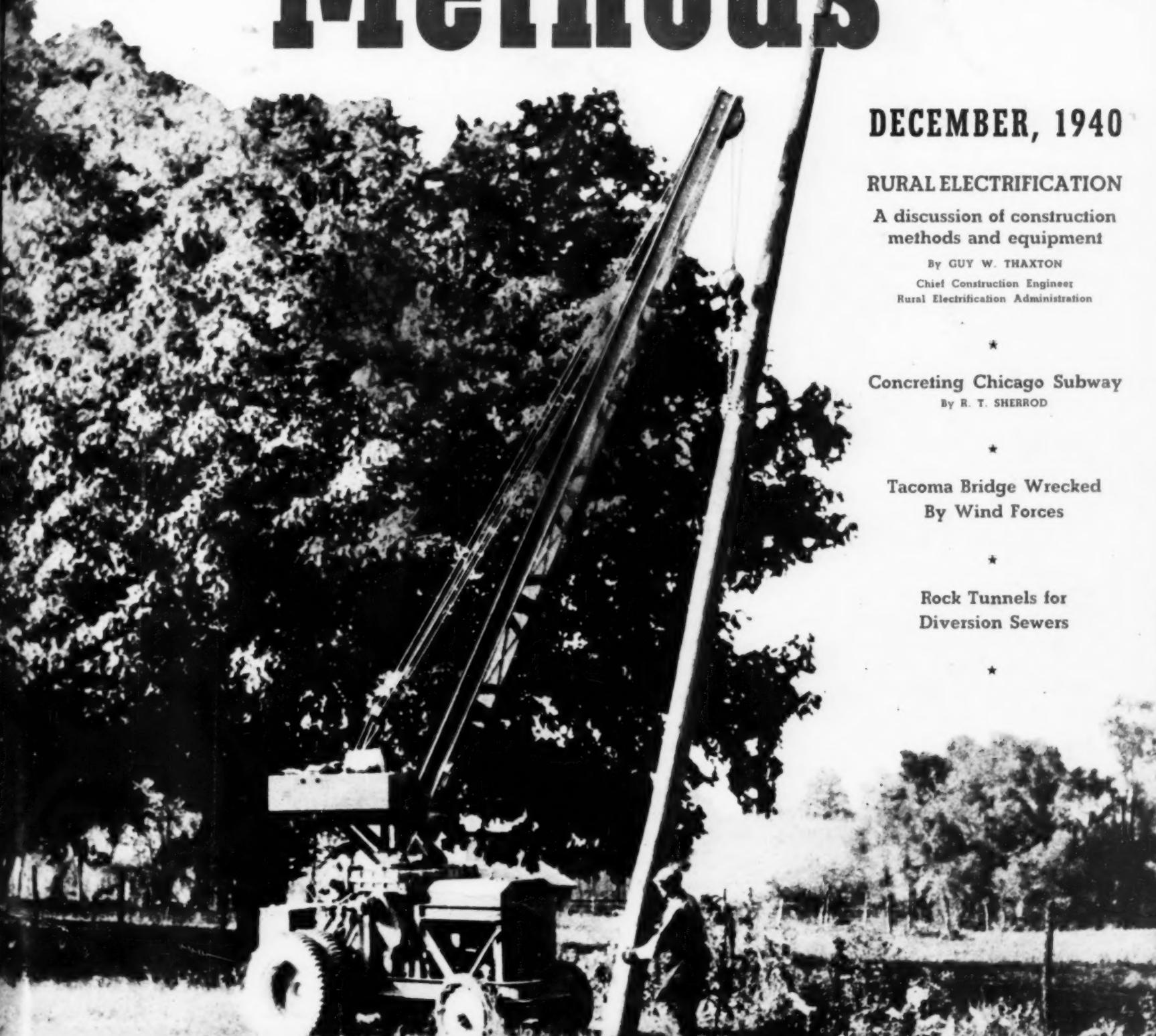
By GUY W. THAXTON
Chief Construction Engineer
Rural Electrification Administration

Concreting Chicago Subway

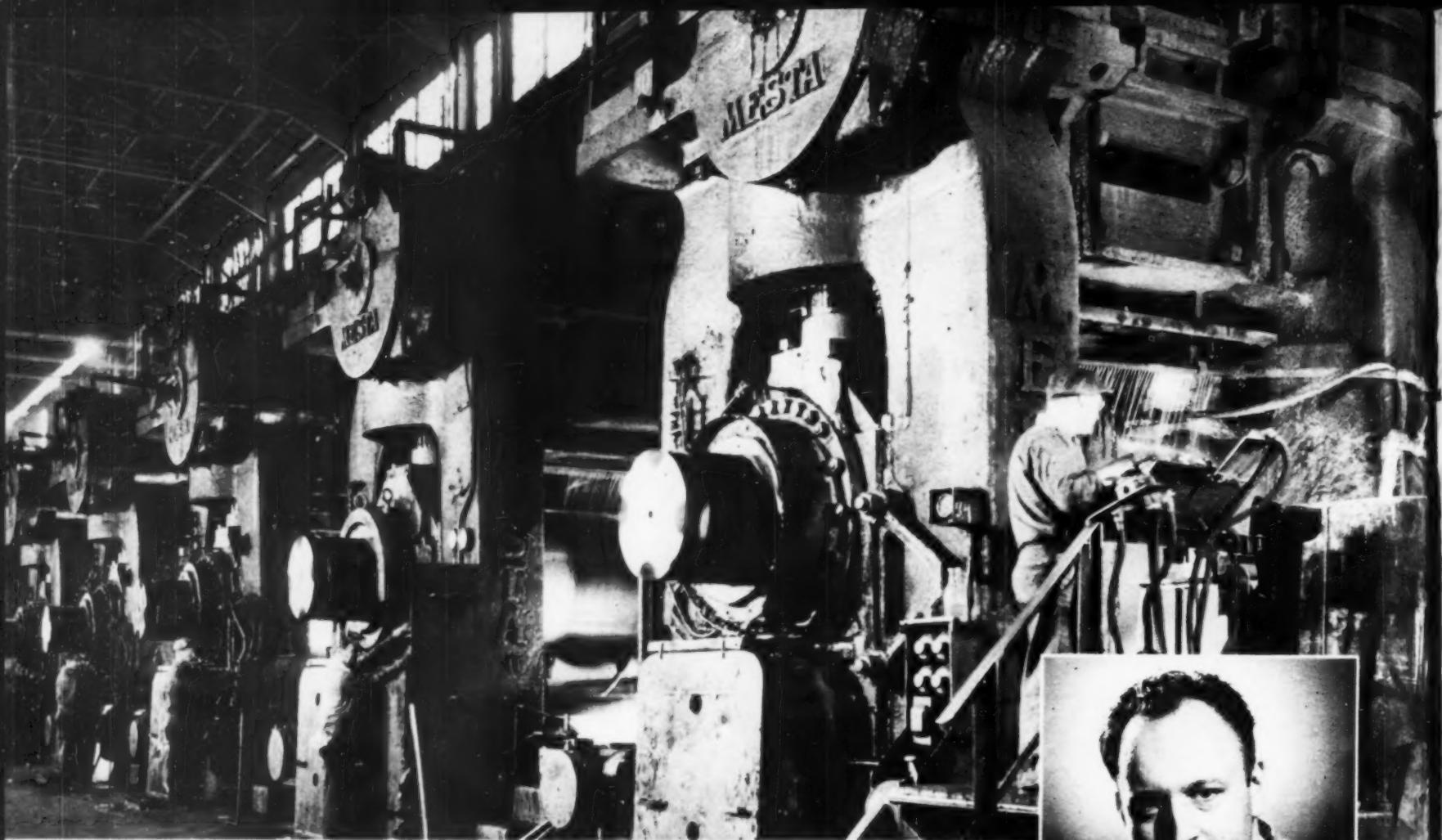
By R. T. SHERROD

Tacoma Bridge Wrecked By Wind Forces

Rock Tunnels for Diversion Sewers



SETTING OF WOOD POLES for rural electrification lines is done with aid of crane boom mounted on wheel tractor.



Modern Mills and Skilled Men CARRY ON THE **INLAND TRADITION FOR QUALITY**

FROM the day Inland made its first steel, emphasis has always been placed on use of the most modern equipment available, the most advanced processes, and men of special training and great skill—the combination which assures highest uniform quality of steel mill products.

Because of this tradition most of Inland's steel-making and finishing equipment has been replaced within the past few years. Typical of recent improvements are: modern blast furnaces; new open hearth furnaces; a blooming mill of exceptional speed and flexibility; new 44-in. and 76-in. continuous sheet and strip mills; latest types of cold reduction mills, a completely rebuilt galvanizing department; new tin mills for production of tin plate by the modern

cold reduction method; and, new furnace and mill control devices that automatically guard quality and uniformity. The Inland steel mill is as modern as any in the world.

Operating the Inland mills are steel makers and metallurgists who know and produce uniform, high quality steel. They are men who have added much to the science of steel processing, and they can be counted on for important advancements to meet the needs of the future.

Many users of steel profit by the Inland tradition for high uniform quality. It saves them time and money. Let Inland's modern mills and skilled men go to work for you.

SHEETS • STRIP • TIN PLATE • BARS • PLATES • FLOOR PLATES • STRUCTURALS • PILING • RAILS • TRACK ACCESSORIES • REINFORCING BARS
TECHNOLOGY DEPT.

INLAND STEEL CO.

38 S. Dearborn Street, Chicago • Sales Offices: Milwaukee, Detroit, St. Paul, St. Louis, Kansas City, Cincinnati, New York

CURRENT JOBS

.... and Who's Doing Them

BUILDINGS

Public—In Burlington, Ia., **Day & Zimmerman, Inc.**, of Philadelphia, Pa., will supervise the construction of shell-loading plant for the War Department for \$34,451,384. Contract for construction of ammunition-loading plant in Union Center, Ind., went to **Bates & Rogers Construction Corp.**, of Chicago, Ill., for \$11,500,000. **Fraser-Brace Engineering Co., Inc.**, of New York, was awarded construction contract for TNT and DNT plant in Weldon Springs, Mo., for \$15,000,000 by War Department. **Douglas Aircraft Co.**, of Santa Monica, Calif., will construct and operate plant expansion, in that vicinity, for War Department, for \$11,254,700 on cost-plus-fixed-fee basis. Contract for construction of explosive-manufacturing plant in Baytown, Tex., went to **M. W. Kellogg Co.**, of New York, **E. B. Badger & Sons Co.**, of New York, and **C. F. Braun & Co.**, of Alhambra, Calif., for \$10,750,000. **Remington Arms Co., Inc.**, of Bridgeport, Conn., submitted estimate for \$10,000,000 to War Department for construction of small arms plant in Kansas City, Mo. In Radford, Va., **Mason-Hanger Co., Inc.**, of New York City, will construct a smokeless-powder plant under supervision of Hercules Powder Co., of Delaware, for \$10,000,000. War chemical plant, covering one square mile area in Winnipeg, Man., Canada, is under construction by **Fraser-Brace Engineering Co. Ltd.** of Montreal, Quebec, Canada, for \$9,000,000. Successful bidders for cantonment contract in Rolla, Mo., were **W. A. Klinger Inc.**, of Sioux City, Ia., **A. H. Neumann & Bros., Inc.**, of Des Moines, **C. F. Lytle Co.**, of Sioux City, and **Western Contracting Corp.**, also of Sioux City, for \$8,428,670.

Doyle & Russell and Wise Construction Co., of Richmond, were awarded contract for reception centers, medical quarters and quartermaster centers in Camp Lee, Va., for \$7,539,051 on cost-plus-fixed-fee basis. At Fort Riley, Kan., **Manhattan Construction Co.**, of Oklahoma City, Okla., received contract for army cantonment, utilities and frame buildings for \$7,060,000. **F. J. Twaits Co.**, of Los Angeles, and **Morrison-Knudsen Corp.**, of Boise, Idaho, were awarded contract by War Department for construction of replacement centers in Sacramento, Calif., for \$6,018,733 on cost-plus-fixed-fee basis. At Pine Camp, Great Bend, N. Y., temporary barracks contract was awarded to **John W. Cowper Co., Inc.**, of Buffalo, and **Senior & Palmer, Inc.**, of New York City, for \$5,823,675 on cost-plus-fixed-fee basis. Cantonment contract at Fort Belvoir, Va., was awarded to **Charles H. Tompkins Co., Inc.**, of Washington, D. C., and **Potts & Callahan Contracting Co.**, of Baltimore, Md., for \$5,784,043. Successful bidders for construction contract, consisting of temporary housing facilities for troops, barracks, mess halls, warehouses, hospital, shops, school and recreational building at Camp Wolters, Mineral Wells, Tex., were **Cage Bros.**, of Austin, and **F. M. Reeves & Son, Inc.**, of Bishop, for \$5,628,000. In Guantanamo, Cuba, the **Frederick Snare Corp.**, of New York, will construct magazine and storehouses, 500-housing units, dredging and moorings for Navy Department for \$5,083,030 on cost-plus-fixed-fee basis.

HEAVY CONSTRUCTION

In Corpus Christi, Tex., training field and additional recreation facilities at Naval Air Station will be built by **Brown & Root, W. S. Bellows and Columbia Construction Co.**, local contractors, for \$3,116,325. Contract for tunnel lining for the Brooklyn-Battery tunnel in New York was awarded to **Bethlehem Steel Co.**, local contractor, for \$3,123,785. Marine railway in Key West, Fla., is under way by **W. P. Thurston Co.**, of Richmond, Va., at price of \$923,000. **Cornell Young Co.**, of Macon, Ga., was awarded contract for dredging and riprap for Santee & Pinopolis reservoirs in South Carolina with price of \$1,439,525. Excavation for main spillway for flood control dam and appurtenances on North Canadian River in Canton, Okla., will get under way by **T. L. James & Co., Inc.**, and **Guilliams Bros.**, of Ruston, La., for \$1,438,652. In New York City, **Nicholas Di Menna & Sons, Inc.**, local contractor, will build bulkhead wall, sewer and fill for \$1,110,615.

HIGHWAYS AND BRIDGES

Among recent highway and bridge contract awards are the following: Connecticut: \$357,874 to **Arute Bros.**, of New Britain. Illinois: \$229,890 to **Union Contracting & Engineering Co.**, of Chicago; \$223,009 to **Rock Road Construction Co.**, of Chicago, \$233,764 to **Standard Paving Co.**, of Chicago, \$223,250 to **Midwest Construction Co.**, of Chicago. Louisiana: \$1,129,200 to **Massman Construction Co.**, of Kansas City, Mo. Pennsylvania: \$282,234 to **Frank Mark Contracting Co.**, of Philadelphia. Grade crossing elimination project in Rockaway, N. Y., is under way by **Charles F. Vachris, Inc.**, of Brooklyn, for \$2,799,019. Toll bridge over Mississippi River between Missouri and Illinois to cost \$1,836,266, will be erected by **Massman Construction Co.**, of Kansas City, Mo. **Arthur A. Johnson Corp. & Necaro Co., Inc.**, of Long Island City, were awarded contract for subway section in Brooklyn, N. Y., with price of \$1,197,512.

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Construction Methods

A Pictorial Survey of Current Practice, Equipment and Materials

ROBERT K. TOMLIN, Editor

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N. A. Bowers (San Francisco) Nelle Fitzgerald

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The HOW of it

For the benefit of readers concerned with the practical application of method or equipment the following references are to articles or illustrations in this issue that tell:

How **RURAL ELECTRIFICATION LINES** are built with modern equipment and methods —p. 42
How **POST-HOLE DIGGERS** are mounted on trucks and tractors for electric line construction —p. 42
How **POLE ERECTION** for electric lines is handled by A-frames and crane booms —p. 43
How **SPECIAL RIG** raises and strings electric wires on poles —p. 45
How **DRYDOCK** was re-built with prefabricated lumber —p. 46
How **RIVER CHANNEL** was paved with concrete to prevent flood damage —p. 47
How **PUMPED CONCRETE** was utilized for lining Chicago subway —p. 48
How **STICKY CLAY** in tunnel was cut by knives pulled by cable from air hoist —p. 49
How **ROCK TUNNEL DRIVING** was done on 6 1/2-mi. sewer project —p. 50
How **TUNNEL MUCK** was handled by conveyor loader —p. 55
How **FLEXIBLE LEAD PIPE** was laid across waterway —p. 59
How **BULK CEMENT** was handled by large steel tanks at batching plant —p. 59
How **ROAD-MIX MACHINE** processed stabilized road surface —p. 60
How **TEN TAMPERS** on road machine compacted stabilized mixture —p. 60
How **ANTI-TANK PILLBOXES** of concrete were built by vacuum process —p. 62
How **SECTIONAL STEEL SCAFFOLD** served as bridge falsework —p. 63
How **CONCRETE RESERVOIR ROOF** was supported on precast concrete framework —p. 64
How **SHE-BOLTS** for concrete forms were made at rate of two per minute —p. 65
How **ELECTRIC WELDING** salvaged corroded stacks —p. 67



"Strike two!"



John insists on getting the utmost use from each piece of equipment!



"Please hurry it up, boys... This isn't doing my business any good!"



SPEED DEFENSE CONSTRUCTION

SAVE VITAL WEEKS THIS WINTER WITH 'INCOR' 24-HOUR CEMENT

MAKE every day count this winter . . . avoid the usual cold-weather slow-down . . . push construction ahead on normal schedules, even in sub-freezing weather. Save time, and money, by using 'Incor' 24-Hour Cement.

Faster Speed, Lower Cost

'Incor', the improved Portland cement, hardens in one-third the usual time. Concrete is safe from freezing, ready to use, that much sooner. Heat-protection costs are 50 to 60 percent lower. Form costs are reduced. Earlier completion cuts overhead or time costs.

'Incor' makes better concrete, too—by curing thoroughly in a fraction of the usual time.

New factories and plant additions, highways, bridges

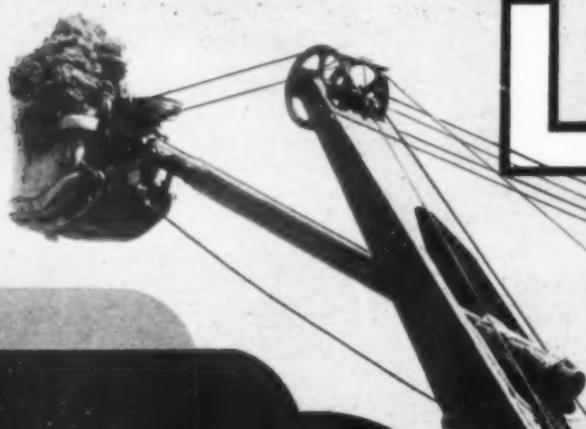
and air-bases—large-scale projects like Indianapolis' Municipal Airport (above), where 80,000 sq. yd. of concrete were used in runways, taxi strips, aprons and driveways—can be pushed straight through the cold-weather months, without the usual costly winter delays, by using 'Incor' 24-Hour Cement.

Change to 'Incor'—Now

Speed defense construction . . . save vital weeks this winter . . . cut cold-weather costs—by changing to 'Incor'* now. 'Incor' is a cold-weather safety factor, proved by over 13 years' performance.

Write for copy of illustrated book, entitled "Cold-Weather Concreting." Lone Star Cement Corporation, Room 2266, 342 Madison Ave., New York. *Reg. U. S. Pat. Off.

LONE STAR CEMENT CORPORATION
MAKERS OF LONE STAR CEMENT . . . 'INCOR' 24-HOUR CEMENT



LIMA PAYMASTER

3/4 yd.

Welded, Box Type Boom
Tubular Dipper Handle
Roller Bearings Throughout
Square Lever Shafts
Hook Cone Rollers
Independent Boom Hoist
Silent Chain Power
Take-off
Chain or Cable Crowd
Ease of Convertibility
Fast, Mobile Crawler Truck

Lima Locomotive Works, Inc.
Shovel and Crane Division,
Lima, Ohio
Gentlemen:
I want to know more about the
Paymaster.

Name _____
Street _____
City _____
State _____

I am in the market.
 I am not in the market.

The many new and original features found in the LIMA PAYMASTER, are geared together to give the user a new conception of power, speed and economy, in the 3/4 yard excavator class.

The PAYMASTER offers the same high quality of materials, expert workmanship, and long, profitable life as is found in the largest size LIMA excavator.

When you buy a 3/4 yard shovel, dragline, crane or pull-shovel, be sure it is a PAYMASTER — the excavator designed to pay big dividends.

LIMA LOCOMOTIVE WORKS, Inc.
SHOVEL and CRANE DIVISION LIMA, OHIO
NEW YORK NEWARK, N. J. DALLAS SAN FRANCISCO SEATTLE
LOS ANGELES MEMPHIS MONTREAL VANCOUVER, B. C.



DEFENSE CONSTRUCTION

CALLS FOR

Speed and Capacity

... AND **EUCLIDS**

Speed . . . speed . . . and MORE speed! Greater capacity than ever before . . . in order to realize in the shortest possible time and with the greatest possible economy those basic structures required for home defense! Whether it be a matter of preparing the groundwork for new highways, new airports, new manufacturing plants, or the many kinds of public works so necessary for increased national security. BOTTOM - DUMP EUCLIDS bring you the experience of YEARS speeding peacetime construction. Their greater capacity, faster dumping, easier maneuvering over all sorts of terrain promise an immediate solution to the need for equipment that can get the maximum of work DONE in the minimum of time allowed. Detailed information on BOTTOM-DUMP EUCLIDS, and all the other kinds of Euclid earth hauling equipment particularly suited to the needs of the day, will be sent on request. Send for descriptive literature today, so you'll have it readily available for reference at a moment's notice!

HAVE PROVEN THEIR ABILITY TO
DELIVER THESE ESSENTIALS ON
MAJOR DIRT-MOVING PROJECTS

Witness:

CALIFORNIA AIRBASE PROJECT — Two 12-YARD EUCLIDS handled 2200 tons of rock every 8 hours over a 1/5 mile haul up a 3% grade.

PENNSYLVANIA TURNPIKE CONTRACT — After hauling heap loads down a 20% grade, BOTTOM-DUMP EUCLIDS dumped and turned on the fill in 16 seconds . . . considerably faster than other conventional equipment on same job.

ILLINOIS GRAVEL PIT — One 8-YARD EUCLID maintains an average 100 cubic yard production over a quarter-mile haul.

OHIO STATE HIGHWAY — Loaded by a 1 1/2-yard shovel, four 13-YARD EUCLIDS averaged 31 pay yards per hour per unit over a full mile haul, including 2000 feet up a 6% grade.

THESE ARE BUT A FEW OF THE COUNTLESS INSTANCES WHERE BOTTOM-DUMP EUCLIDS HAVE PROVED THEIR GREATER SPEED AND CAPACITY ON MAJOR EARTH MOVING PROJECTS EVERYWHERE . . . PROOF THAT THEY ARE ABLY QUALIFIED TO HANDLE ANY EMERGENCY ASSIGNMENT!

THE EUCLID ROAD MACHINERY CO.
CLEVELAND, OHIO U. S. A.

Bottom-Dump Euclids • Rear-Dump Euclids • Track Wheel Wagons (side dump type) • Tamping Rollers





READY FOR YOUR TOUGHEST JOBS RIGHT FROM THE START!

THERE'S a reason why the Ford Motor Company has built and sold more trucks than any other manufacturer. It's because Ford units give a full measure of service from the start.

For example, you get full value from your new Ford Truck the very moment you put it to work on your job. Its precision-built engine does not have to be "broken in"! By the time the first 100 miles have clicked across the speedometer, you

can drive your unit as fast as the law and road and traffic conditions permit. No "coddling" here. Your new Ford Truck pays dividends from the day you take delivery.

Because of rugged construction, top performance and high dependability, you can count on Ford operating economy.

Put a Ford Truck to work for you in 1941! Ask your dealer for a free "on-the-job" test that will prove what a Ford V-8 Truck can do for you under your own operating conditions.

FORD TRUCKS and Commercial Cars

FORD MOTOR COMPANY - BUILDERS OF FORD V-8 AND MERCURY CARS.
FORD TRUCKS, COMMERCIAL CARS, STATION WAGONS AND TRANSIT BUSES





HEIL DIG-N-CARRY SCOOps GIVE YOU *Extra Yardage* *Extra Profits*

Heaping payloads every time with Heil Cable Scoops! Their **EXTRA PAYLOAD** means **EXTRA PROFITS** for contractors everywhere.

PERFORMANCE RECORDS PROVE HEIL "EXTRA YARDAGE" CLAIMS

It's the "payload" that counts—that's why contractors who know their "pay dirt" are switching to Heil Dig-N-Carry Scoops. Here's what makes 'em "stop, look and investigate." On one job, where careful records were kept, a 16 yard Heil cable scoop actually hauled $3\frac{1}{2}$ more yards per trip—or figuring on a basis of 80 trips per 8 hour day, the Heil Scoop moved 280 more yards than a similar capacity competitive unit . . . More yardage per day means more profits per job . . . Now is the time to investigate . . . Write, wire or phone for Heil recommendations before you buy.



Heil Hydraulic Bulldozers are
Big — Sturdy — Powerful.

Heil Hydraulic Dump Units offer de-
pendable, long time service.

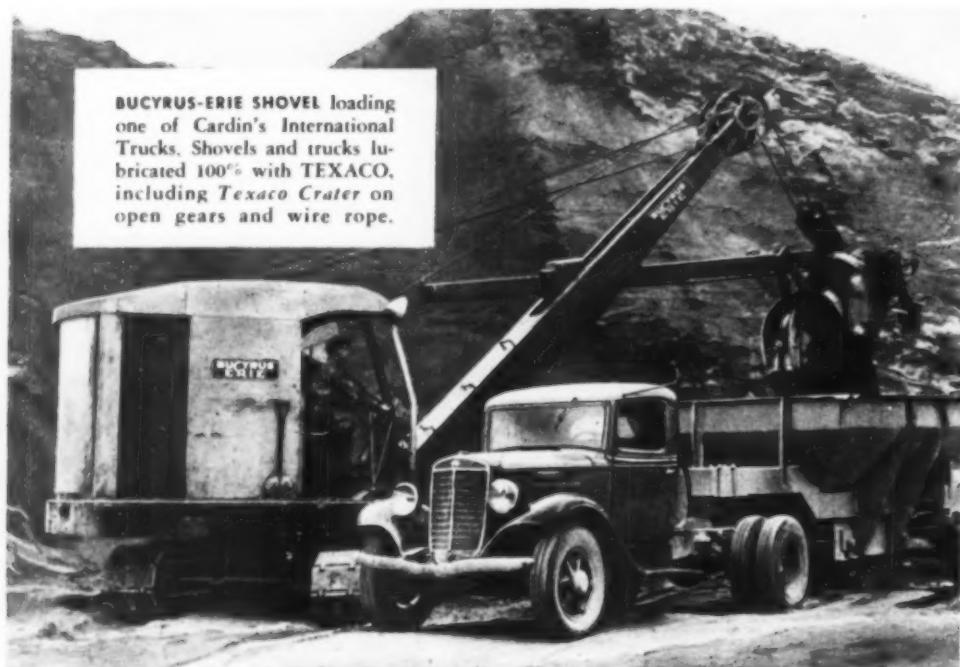
THE HEIL CO.



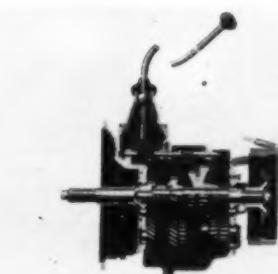
MILWAUKEE, WISCONSIN
HILLSIDE, NEW JERSEY

TRUCKS STAND UP!

... Hauling Mountains of Oklahoma Chat



BUCYRUS-ERIE SHOVEL loading one of Cardin's International Trucks. Shovels and trucks lubricated 100% with TEXACO, including *Texaco Crater* on open gears and wire rope.



TEXACO THUBAN for truck transmissions and differentials—assures easy gear shifting in winter weather, reduces drag.



TEXACO MARFAK is adhesive and cohesive, clings to metal, seals itself in while dirt, grit, and wheel splash are sealed out.



TEXACO CRATER penetrates wire rope, protecting each strand against wear and weather . . . on open gears, reduces friction, prevents corrosion.

HAULING mountains of heavy ore over hot, dusty, unpaved roads in its fleet of International Trucks, this Oklahoma fleet operator has lengthened engine, chassis, and wheel bearing life, stepped up mileage between lubrications.

For 5 years, Cardin Mining and Milling Company trucks, shovels, and equipment in 3 mills have been lubricated with TEXACO.

Texaco 303 Motor Oil keeps engines clean and rings free, assuring piston seal and full power.

Texaco Marfak protects wheel bearings and chassis parts against wear twice as long as ordinary grease.

Texaco Thuban provides efficient lubrication for transmissions and differentials under the heaviest loads.

Texaco engineers will gladly cooperate in showing how you, too, can make savings with Texaco truck lubricants. Phone the nearest of more than 2300 Texaco warehousing points in the 48 States, or write:

The Texas Company, 135 E. 42nd St., New York, N. Y.



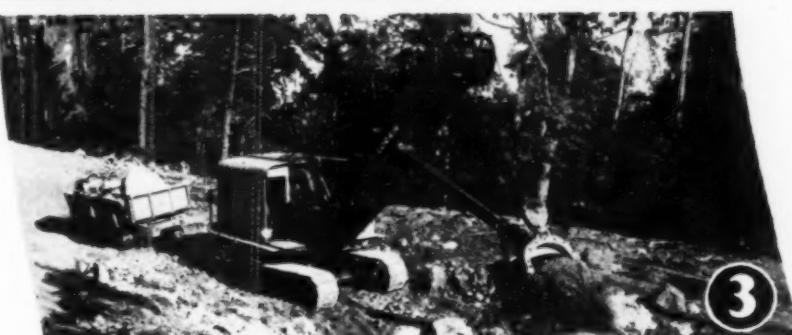
TEXACO DEALERS INVITE YOU TO ENJOY

FRED ALLEN in a full-hour program every Wednesday night. CBS, 9:00 E.S.T., 8:00 C.S.T., 10:00 M.S.T., 9:00 P.S.T.

METROPOLITAN OPERA every Saturday afternoon, NBC. See local newspaper for time and station.

TEXACO Truck Lubricants

The
SKYLINE
is still a
LORAIN JOB



• There's been no change in the shovel score since work started on the 400-mile Skyline Highway back in 1934. Then, two out of every 3 units on this job were Lorains—and here's evidence of how new Lorains still dominate the project.

Many of the same contractors who started this project have bid in additional sections. The fact that they have come back for more in the face of some of the country's toughest digging indicates they made a profit on their first jobs. And the fact that they repeat on Lorains indicates also that they give these shovels a fair share of the credit for their success—and here's proof of how they continue to rely on Lorains.

Six years of continued acceptance—performance proved on millions of yards of excavation—what better testimonial to the stamina and economy of Lorain shovels and their Center Drive design could you ask?

THE THEW SHOVEL COMPANY
LORAIN, OHIO

1 This 1½-yd. Lorain-80* is one of 4 Lorains Albert Bros., Inc. have in service on their 19-mile Blue Ridge Parkway contract which totals 1,330,000 yds. Albert Bros., Inc. have purchased 8 Lorains to date.

2 Ralph E. Mills Co., Inc. uses a 2-yd. Lorain-87 on their Skyline section. They've owned 9 Lorains.

3 W. W. Tuck & Son (7 Lorains) chose a new 1½-yd. Lorain-80* for their Skyline job.

4 Chandler Bros., Inc. (7 Lorains) are using two 1½-yd. Lorain-80's* and 2 other Lorains to handle 1,000,000 yds. of excavation on their current 11-mile Skyline contract. This company has completed 28 miles of previous contract totaling 1,400,000 yds. with Lorain shovels.

5 This 1½-yd. "80"** is one of two Lorains serving Sutton Company, Inc. on their 490,000-yd. Skyline contract. Sutton has had 9 Lorains in all.

*These "80's", all illustrated above, were purchased by these contractors when awarded their most recent Skyline sections.



LORAINS

Thor

New No. 23 Paving Breaker

handles like a lightweight . . . wallops like a heavy!

PERFECTLY BALANCED

streamlined design makes the No. 23 easy to handle. The sturdy backhead is equipped with rubber grips to keep the handle cool.

A MORE POWERFUL BLOW

is produced by a block type piston hammer of new design. Piston is reversible for longer life. Cylinder specially designed to give full effect to every hammer blow.

QUICKER STEEL CHANGES

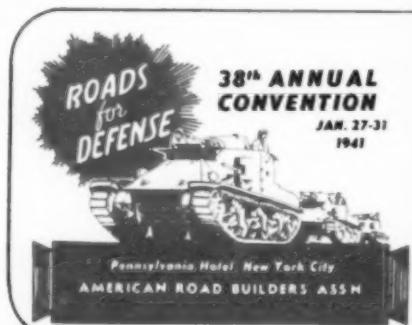
Made possible by new Thor Latch Type Retainer. Simple, positive and efficient. Operator has only to step on latch to insert or remove steel.

Extra POWER → Extra OUTPUT → Extra PROFITS

Until Thor's new No. 23 Paving Breaker came along you often had to sacrifice speed when you needed power, sacrifice power when you needed speed. Now you get both speed and power in *one* tool! For this new medium weight breaker handles like a lightweight and wallops like a heavy! Elimination of every ounce of excess weight has made the Thor No. 23 a trim, compact tool weighing only 59 pounds. A block type piston hammer of new design gives it a great reserve of surplus power. This and other exclusive Thor construction features make the new Thor No. 23 a machine that will make more money for you by boosting output on every demolition job!

For full information write for BULLETIN JMC-26C.

Page 12 — CONSTRUCTION METHODS — December 1940



Thor
Portable Power
TOOLS

INDEPENDENT PNEUMATIC TOOL CO.

600 W. JACKSON BLVD., CHICAGO, ILL.

Cochise Rock Drill Mfg. Co. (Division), 6200 E. Slauson Ave., Los Angeles, Calif.

Birmingham
Milwaukee

Boston
New York
St. Louis

Buffalo
Philadelphia
Toronto

Cleveland
Pittsburgh
London

Detroit
San Francisco

Concreting on the

DOUBLE-QUICK . . . MARCH!



... Army Barracks at Camp Edwards, Mass., completed quicker with Atlas High-Early Cement!

ACH DAY 600 barrels of Atlas High-Early are being used for the concrete foundations to speed up construction at Camp Edwards. 1200 separate buildings, requiring 30,000 cu. yds. of concrete, will be completed by December, 1940.

On this project, like many others all over the country, engineers and contractors know they can depend on Atlas High-Early—the cement that gains working strength rapidly. It cuts time for protection and curing as much as 60—70%, often

permitting earlier stripping and re-use of forms. But most important, it produces serviceable concrete in much less than the usual time.

Whether your next job is government or private, specify Atlas High-Early. For information, write Universal Atlas Cement Co. (United States Steel Corp. Subsidiary), Chrysler Bldg., N.Y.C.

Offices: New York, Chicago, Phila., Boston, Albany, Pittsburgh, Cleveland, Minneapolis, Duluth, St. Louis, Kansas City, Des Moines, Birmingham, Waco.

● Atlas High-Early cement speeds up construction of Camp Edwards, United States Army Cantonment at Falmouth, Mass. General Contractors, Walsh Construction Co., Davenport, Iowa. Below: Newly stripped concrete foundation walls of one of the 1200 separate buildings making up the camp.



CM-H-23

ATLAS HIGH-EARLY CEMENT

A UNIVERSAL ATLAS PRODUCT



Announcing

A New Companion to the Fast-Moving Standard C Tournapull



THE SUPER C TOURNAPULL

With **MORE POWER** —
125 and 150 H.P.
— and **GREATER CAPACITY**
— 15 Heaped Yards
— for your **LONG HAULS**.



LESS than six months ago we announced the Standard C Tournapull (90 H.P.) with LS Carryall Scraper (11 heaped yards). Alert contractors the country over bought one and two for trial, quickly found them to be the fastest, cheapest method of long-haul earthmoving on the market, soon became fleet users.

For More Yardage per Hour

Profitable as the Standard C has proved, many contractors have asked us for a Tournapull of similar size but with more power and greater capacity for use on jobs demanding still more yardage per unit per hour. Our answer is the Super C Tournapull, powered by either a 125 or 150 H.P. Diesel engine, to handle an LP Carryall Scraper with 15 heaped yards capacity.

Same Profitable Operating Speed

Like the fast-moving, job-proved Standard C, the bigger-powered Super C Tournapull utilizes the power of a "Caterpillar" D8 pusher unit to cut loading time and heap on capacity Carryall loads in a hurry. It attains high-gear hauling speed quickly, spreads its load on the fill without stopping and high-balls back to the cut for another load — all in one continuous operating cycle. No need for special spreading equipment on the fill . . . no waiting in line at a shovel . . . thus you further increase earthmoving efficiency, cut costs and earn more profit on larger long-haul jobs.

Try the Super C Tournapull. See for yourself what it can do on your long-haul work. Ask your LeTourneau-Caterpillar dealer to demonstrate NOW!

Super C Tournapull is Completely Equipped . . . No Extras to Buy

Standard equipment on the Super C Tournapull includes brakes on both Tournapull and LP Carryall Scraper; front crankcase guard with front pull hook and bumper; electric lights*, starter* and horn*; operator's cab; Carryall pusher block*. There are no extras to buy — your first price includes everything.

*Also standard equipment on Standard C Tournapull — brakes, guard and cab optional at slight extra cost.

SPECIFICATIONS IN BRIEF

Standard C	Super C
Horsepower	90
Shipping Weight	25,300 lbs.
Carryall Model	LS
Heaped Capacity	11.2 yds.
Struck Capacity	8.2 cu. yds.
	12.1 cu. yds.

For more complete details see your LeTourneau-Caterpillar dealer or write Dept. CM.



150 h.p. Super C Tournapull with LP Carryall Scraper (15 heaped yards capacity) designed for pusher loading to get capacity yardage fast.

Part of Cavanaugh Construction Company's fleet of four 90 h.p. Standard C Tournapulls with LeTourneau LS Carryall Scrapers (11 heaped yards) handling the long-haul earthmoving on Carey Dam, Carey, Idaho.

LETOURNEAU

PEORIA, ILLINOIS . STOCKTON, CALIFORNIA

CARRYALL® SCRAPERS, ANGLEDODZERS®, BULLDOZERS, ROOTERS®, POWER CONTROL UNITS, DRAG SCRAPERS, CRANES, PUSHDOZERS, SHEEP'S FOOT ROLLERS, TOURNApULLS®, TOURNAtrailERS®

*Name Reg. U. S. Pat. Off.

NO
NORTHWEST
WELDED BOOM
HAS EVER FAILED!



GASOLINE
• ELECTRIC
• DIESEL
• OIL

Built
in a range
of 18 SIZES
3/8 yd. capacity
and
Larger

One of the 13 Northwests purchased
by Morrison-Knudsen of Boise, Idaho

NORTHWEST Welded Booms have
been standard equipment for
nearly seven years, and no Northwest
Welded Boom has ever failed!

You could not ask for a better guarantee
of the strength and dependability
you require than performance that
makes the above statement possible.

NORTHWEST ENGINEERING CO.
1728 Steger Bldg., 28 E. Jackson Blvd.
Chicago, Illinois

REMEMBER!
.... If it's a
real Rock Shovel
you won't have
to worry about
output in dirt!

NORTHWEST

SHOVELS • CRANES • DRAGLINES • PULLSHOVELS

Greater
Safety

Dependable
Action

Two
Great Advantages
Linked together in

ATLAS MANASITE DETONATORS

Another
"ATLAS
FIRST"

Greater Safety—the constant aim of new developments in blasting methods—takes an important step forward in Atlas Manasite detonators. Through reduced sensitivity to impact and friction, Atlas Manasite detonators make safety precautions not less important, but more effective. Yet they cost no more.

Dependable Action—a "must" in any blasting development—is inherent in Atlas Manasite detonators. Reorders and new orders tell the story: over 80,000,000 Atlas Manasite detonators already have been used.

Ask your Atlas Representative for full details.

ATLAS EXPLOSIVES
"Everything for Blasting"



ATLAS POWDER COMPANY, Wilmington, Del. • Offices in principal cities • Cable Address—Atpowco

HAZARD LAY-SET
Preformed...
At Ease on every job

● Regardless of the machine or job—shovel, crane, hoist, scraper, elevator, whatnot—Hazard LAY-SET Preformed will give you the same amazing resistance to fatigue, the same uniformly long life—because Hazard LAY-SET is “at ease.” The preforming process at the mill relieves the rope of locked up stresses; leaves it flexible, easy to handle, willing to work. Hazard LAY-SET Preformed is so calm, so thoroughly “at ease,” that it has almost no tendency to kink, it resists whipping or rotating in sheave grooves, it spools better. More than this Hazard LAY-SET Preformed is a safer rope to handle. Being “at ease” broken crown wires do not spring out to tear workmen’s hands and possibly cause blood-poisoning. For your next rope specify Hazard LAY-SET Preformed and be “at ease” yourself about its greater dollar value.

HAZARD WIRE ROPE DIVISION • WILKES-BARRE, PENNSYLVANIA

Established 1846

District Offices: New York, Chicago, Philadelphia, Pittsburgh,
Fort Wayne, San Francisco, Denver, Los Angeles, Atlanta, Tacoma



AMERICAN CHAIN & CABLE COMPANY, Inc.



WHO'S BOSS...



YOU DON'T need sunshine to make money when you're equipped with "Caterpillar" Diesel Tractors. Because here's power that can keep the yardage rolling—on its own hook—even along a hip-boot haul-road!

Long, wide-grousered tracks working with a careful balance between engine-horsepower and tractor-weight give "Caterpillar" Diesels enough stubborn pulling-drive to wade through on schedule—and wangle the load with them! Protective devices around the vital parts guard against mud, water and grit. Easy maneuverability gives quick spotting under the shovel.

Get right down to it, and you'll find that "Caterpillar" Diesels are engineered to handle your work at a profit under just about any conditions you'll run up against. And on top of their weather-beating, load-moving power, you get a fuel-economy that cuts your costs by the hour—and a rugged dependability that means less down-time! See your nearest "Caterpillar" dealer or write direct to the factory for further information.

CATERPILLAR TRACTOR CO., PEORIA, ILLINOIS

- 275,000 yards of earth and rock being moved during Spring thaw and rains by a fleet of "Caterpillar" Diesel D8 Tractors and Athey wagons. Relocation of State Highway 271, near Johnstown, Pennsylvania. Harrison Construction Co., Pittsburgh, had the contract.



CATERPILLAR

REG. U.S. PAT. OFF.

DIESEL ENGINES AND ELECTRIC SETS • TRACK-TYPE TRACTORS • ROAD MACHINERY

YOU OR THE WEATHER?



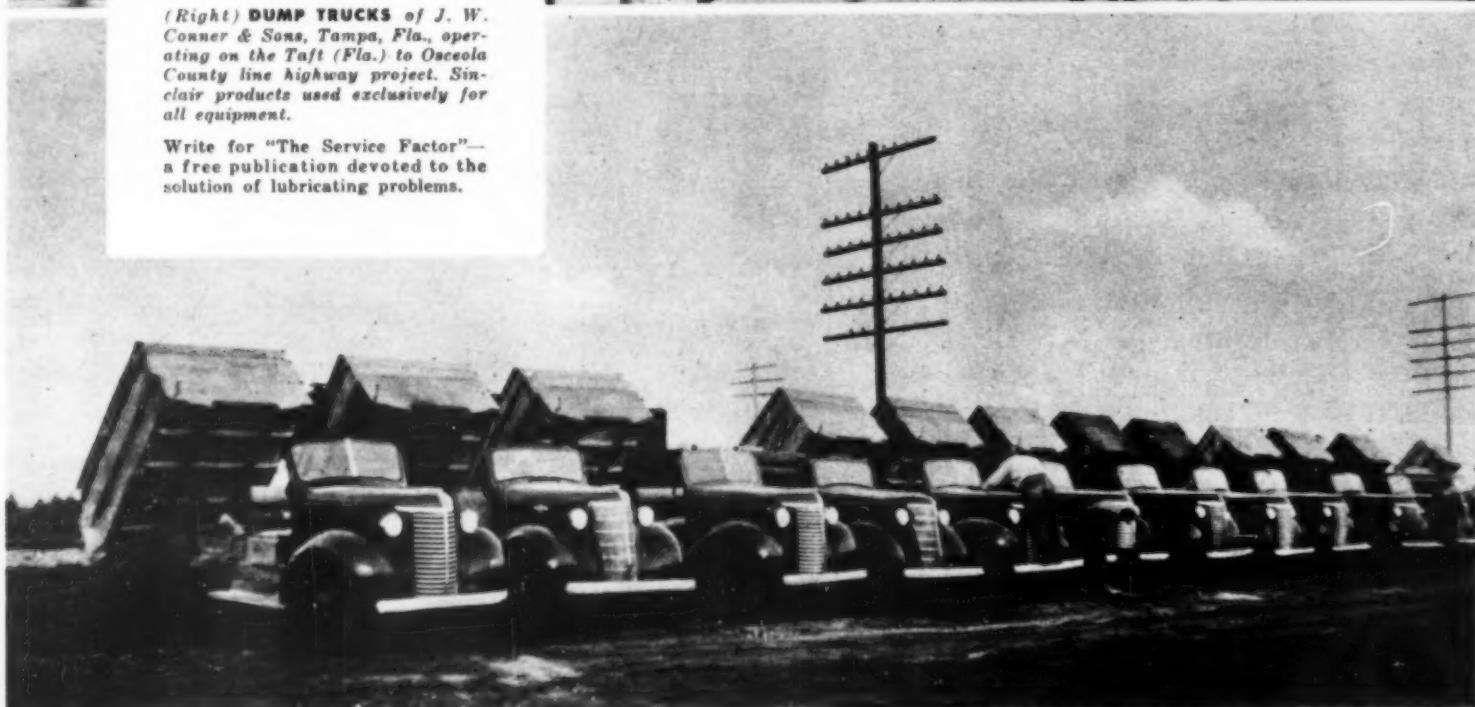
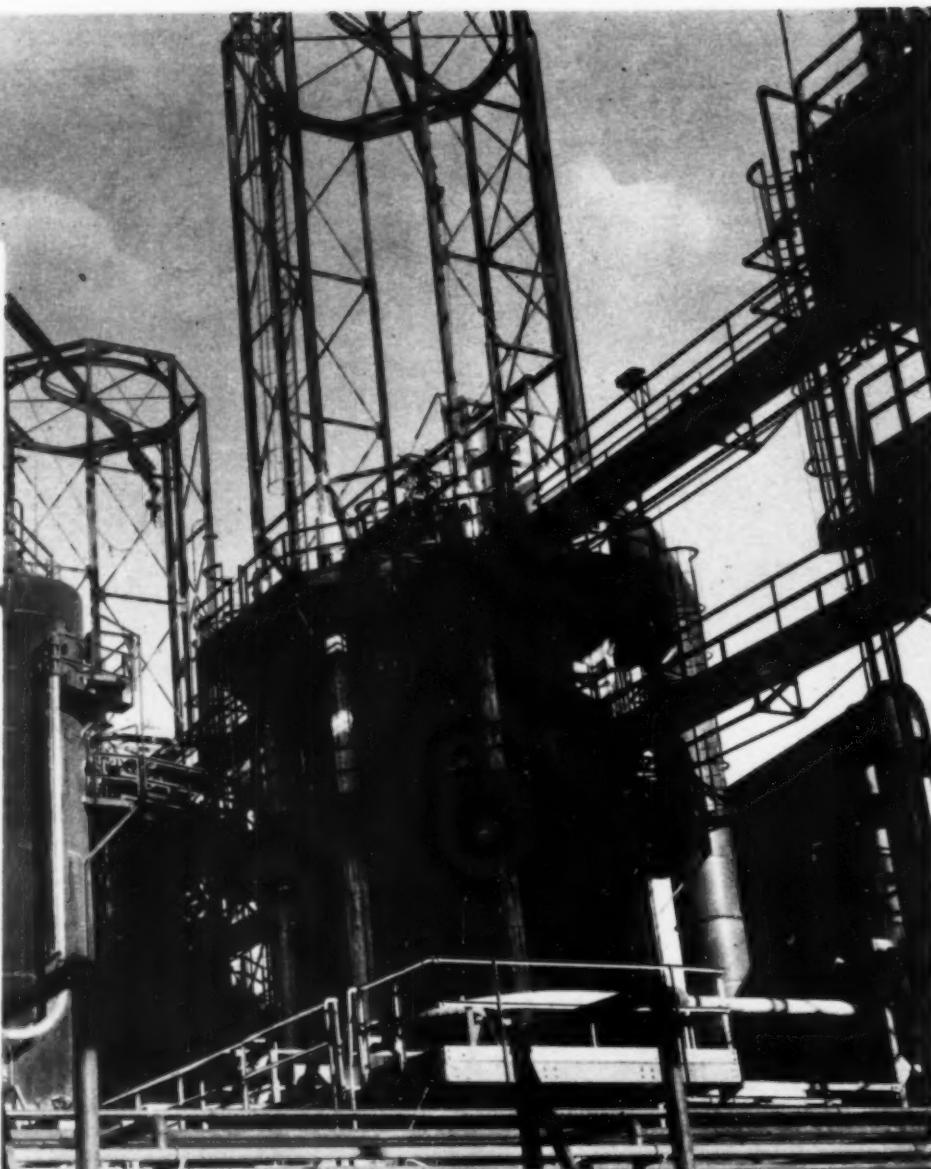
142 CLASSES OF SPECIALIZED LUBRICANTS

have been developed in Sinclair refineries to meet the exacting requirements of modern industrial equipment. For road construction machinery...

... **SINCLAIR OPALINE** and **SINCLAIR PENNSYLVANIA MOTOR OIL** stand up under rigorous operating conditions. These and other Sinclair lubricants and fuels promote continuous operation of all types of road building machinery at low upkeep expense. For quick deliveries of Sinclair fuels and lubricants, write the nearest Sinclair office or to Sinclair Refining Company, 630 Fifth Avenue, New York, N. Y.

(Right) **DUMP TRUCKS** of J. W. Conner & Sons, Tampa, Fla., operating on the Taft (Fla.) to Osceola County line highway project. Sinclair products used exclusively for all equipment.

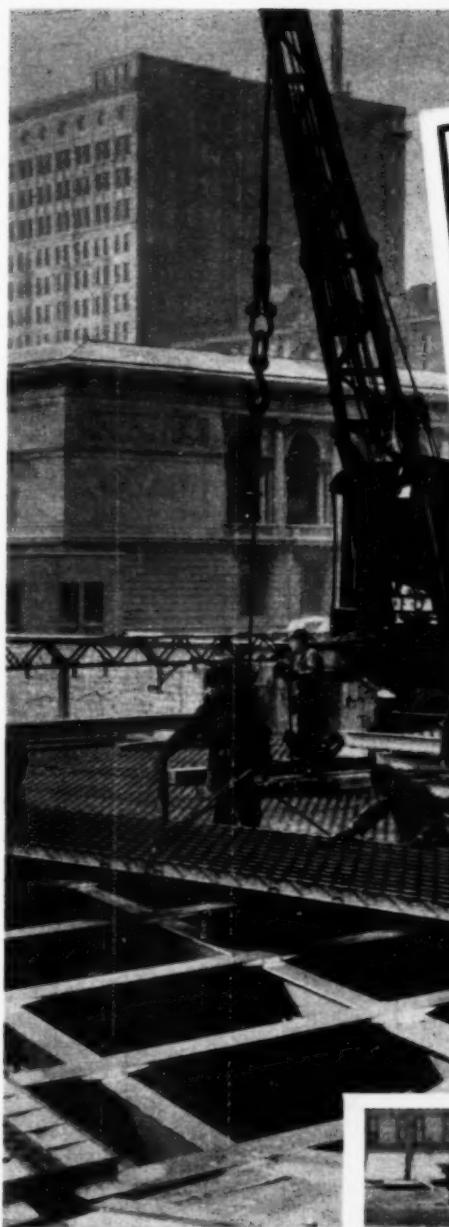
Write for "The Service Factor"—a free publication devoted to the solution of lubricating problems.



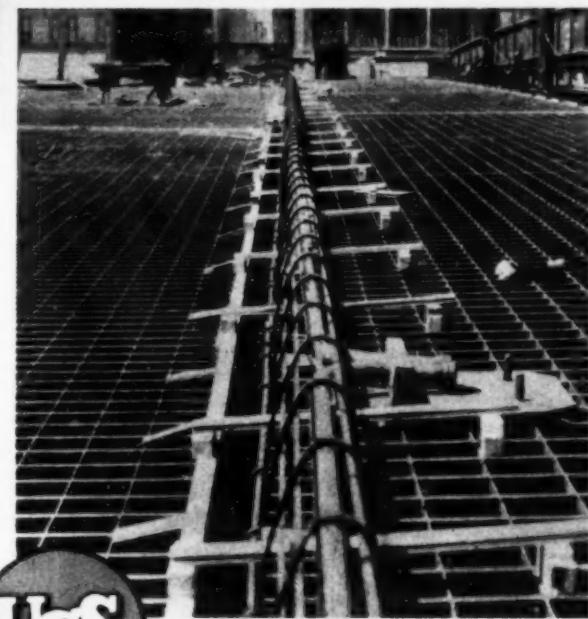
SINCLAIR LUBRICANTS-FUELS

SINCLAIR REFINING COMPANY (Inc.)

2540 W. CERMAK RD. CHICAGO • 10 W. 51ST ST. NEW YORK • 1907 GRAND AVE. KANSAS CITY • 573 W. PEACHTREE ST. ATLANTA • FAIR BUILDING, FT. WORTH



"The smoothest-riding bridge deck in Chicago...and, incidentally, the simplest, easiest floor to install."—say PARK DISTRICT ENGINEERS



PLACING PANELS. In order that these floor panels would bear evenly and present a smooth, even surface, great care was taken in adjusting steel work prior to riveting, and to set each girder with top flange at exact elevation. No shimming was necessary.

THIS NEW VIADUCT was designed under the supervision of Lyman C. Riggle, Structural Designer, Chicago Park District. Field engineering was under the supervision of Lawrence T. Smith, Resident Engineer, Chicago Park District. General Contractors—Kettler-Elliott Company, Chicago, Ill.



UNITED
STATES
STEEL

U-S-S I-Beam-Lok Armored Floor

CARNEGIE-ILLINOIS STEEL CORPORATION

Pittsburgh and Chicago

Columbia Steel Company, San Francisco, Pacific Coast Distributors

United States Steel Export Company, New York

December 1940—CONSTRUCTION METHODS— Page 21

THE new Monroe Street Viaduct built by the Chicago Park District across the Illinois Central-Michigan Central tracks in Grant Park, Chicago, graphically illustrates the important economies that can be effected by fully utilizing the possibilities of U-S-S I-BEAM-LOK Flooring.

Constructed to take care of the heavy vehicular traffic originating in the nearby Loop, this new viaduct is 85 ft. wide—25 ft. wider than the old structure it replaces. Has roadway 60 ft. wide—26 ft. wider than before.

"Lightness was essential in the new work," say the Park District engineers. "Because of the reduced slab dead load of the I-BEAM-LOK deck, considerable economy was secured by utilizing the old pile foundations. The fact that the $4\frac{1}{4}$ " I-BEAM-LOK used, when filled with concrete, weighed only 55.5 lbs. per sq. ft. further enabled us to reduce deck thickness to secure a 2-foot reduction in crown, and also made it possible to use much lighter main girders."

Photographs shown here indicate how the job was handled. Although this construction was made over heavy railway traffic and was carried on above an overhead catenary system carrying 1500 volts, this difficult and dangerous project was completed without a single electrical accident. The ease of handling of the I-BEAM-LOK sections and the fact that no riveting or bolting was required, and that all welding was done downhand from above the structure, speeded up the work, insured a better job, and were important factors in keeping the safety record clear.

Do you wonder that to date more than 3 million sq. ft. of U-S-S I-BEAM-LOK are in use? It has been used to refloor the famous Queensboro, Manhattan and Williamsburg spans in New York. It is used on the new Bronx-Whitestone Bridge—on the Thousand Island Bridge across the St. Lawrence—on the International Highway Bridge at Port Huron—on the Outer Drive Bascule Bridges at Chicago—and on other famous old and new structures designed by the most prominent authorities in the bridge engineering field. Find out about U-S-S I-BEAM-LOK—the modern floor for modern traffic. Our engineers will gladly discuss its economies and possibilities.

Fast... Dependable... Profitable from Start to Finish

Land Clearing

LA PLANT-CHOATE

Land Clearing and Earth Moving Equipment

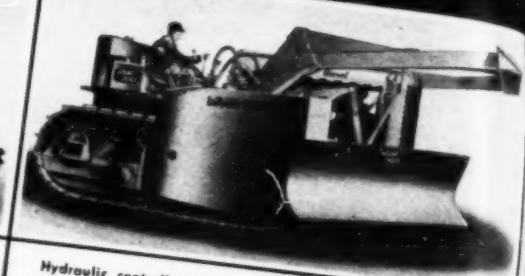
• A Complete Line from One Source

IVEN on these very tough and complicated jobs, LaPlant-Choate equipment will do its work at a saving for you. These tools have all been field-tested under the most gruelling kind of work . . . and their performance substantiates all claims made for them. That's why thousands of successful operators always rely on LaPlant-Choate equipment. These men know that LaPlant-Choate tools help take the "guesswork" out of bidding and doing the job.

These rugged, powerful land clearing and earth moving tools are sold by LaPlant-Choate and "Caterpillar" dealers everywhere. This is your assurance of competent, readily available sales and service facilities. Get full details today. Write for Free literature.



Hydraulic controlled Brushcutter. Cuts brush and trees off flush with ground. Available for "Caterpillar" D-7 and D-8 Tractors.



Hydraulic controlled Dozer for complete removal of trees and roots. Available for "Caterpillar" D-7 and D-8 Tractors.



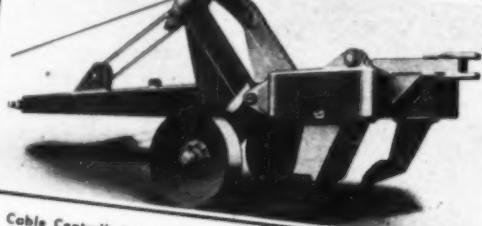
Cable controlled Brush Rake for removing brush and roots, rock picking, and piling brush and trees for burning. Available with Hydraulic or cable controls for "Caterpillar" D-7 and D-8 Tractors.

Hydraulic controlled Rootcutter. Cuts roots off 10" under ground line. Available for "Caterpillar" D-7 and D-8 Tractors.

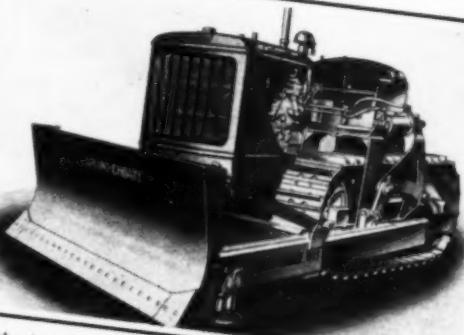
Earth Moving



Hydraulic controlled rear dumping scrapers for building approaches, backfilling around bridges and culverts and other regular scraper jobs. Available in 3 sizes 4 to 8 yd. capacities.



Cable Controlled Heavy duty Ripper for ripping hard pan or rocks. For use with "Caterpillar" D-7 and D-8 Tractors.



Hydraulic controlled Trailbuilder for pioneering work preparing right of way, and later for finishing operations. Available with Hydraulic or Cable Controls for all sizes of "Caterpillar" Track Type Tractors.



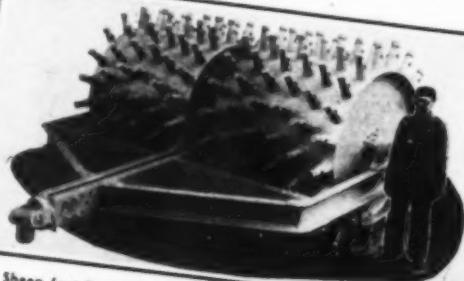
Cable controlled scraper Pusher with Spring Cushioned shock absorber for pushing to speed up and increase loads of larger forced ejection type scrapers. Available with Hydraulic or Cable Controls for "Caterpillar" D-7 or D-8 scrapers.



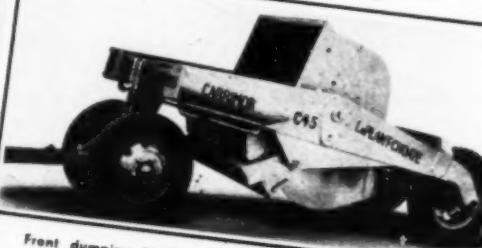
Forced Ejection type Scrapers Available with cable control in four sizes, 12 yd. to 30 yd. capacities.



Cable Controlled Bulldozer for spreading, leveling, backfilling, or any bulldozing job. Available with Hydraulic or Cable Control for all sizes of "Caterpillar" Track Type Tractors.

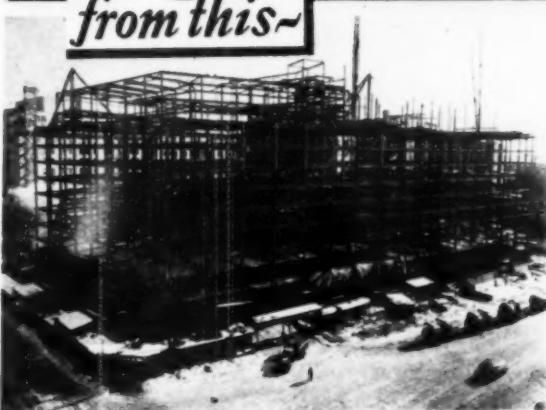


Sheep foot Tamping Roller for compacting fills. Available in various sizes to meet any tamping specification.



Front dumping Hydraulic controlled scraper with controlled spreading for shoulder and ditch work, leveling between pavement forms and other regular scraper work. Available in two sizes 3 and 4 yd. for use with "Caterpillar" D-2 and D-4 Tractors.

LA PLANT-CHOATE MANUFACTURING CO. Inc. CEDAR RAPIDS IOWA



LAFAYETTE BLDG., 15th & I Sts., N.W., Washington, D.C.
ARCHITECTS: A. R. Clas & Associates, Washington,
D. C. Holabird & Root, Chicago, Ill.
ENGINEER: A. J. Scullen, Washington, D. C.
GENERAL CONTRACTORS: Thompson-Starrett Co., N.Y.
CONCRETE CONTRACTORS: Senn-Herrick Corp., N. Y.

A SHORT CUT *For the Winter Job*

CONSTRUCTION tempo is rapidly changing with America's call for speed—and more speed. As any contractor knows—in concrete construction, the sooner the concrete reaches service strength, the faster the job will move. Many contractors have turned to Lehigh Early Strength Cement, because it steps up their jobs by making service strength concrete 3 to 5 times faster than normal portland cement. It does this in any season—in winter, besides, its quick curing reduces heat protection costs one-half to two-thirds and is added protection against frost damage.

The Lafayette Building in Washington, D. C., is a typical example. With the steel erected and the floors ready for pouring with normal cement, a call came for quick occupancy. The answer to the demand was quick service concrete made with Lehigh Early Strength Cement. Forms were removed in 4 days instead of 14 to 21 as originally specified. Poured in sub-freezing weather, heat curing costs were cut more than half. In 8 weeks, the Senn-Herrick Company completed the basement, 12 floors and roof slab. Other trades stepped-up their work because the concrete quickly reached the specified strength, was ready for use.

You can step up your concrete work for any purpose by using Lehigh Early Strength Cement—you can save time and often reduce costs, too.

The Lehigh Service Department is at your disposal without obligation.



LEHIGH PORTLAND CEMENT COMPANY

Allentown, Pa., Chicago, Ill., Spokane, Wash.

One of a series of advertisements sponsored by Engineering News-Record and Construction Methods to remind readers of the important role the distributor plays in the economics of construction.



Contractors on defense projects find distributors more valuable allies than ever

The pressure under which construction machinery and equipment are being worked today calls for prompt service on parts. There can be no horse-power sit-downs any more than there can be man-power tie-ups. Continuous operation is the order of the day.

Sources of parts, materials and supplies must be in close proximity to every vital defense project. And they are, thanks to our national network of distributors and manufacturers' branches.

For instance... our naval air base in Rhode Island

For repair parts, for materials, for equipment, for supplies, the contracting organizations handling this Quonset project have only to lift the phone and call Providence, Boston, Taunton, Fall River, New

Bedford or New London to get distributors to fill their wants promptly. Well stocked warehouses make day and night deliveries possible. Some of these distributors are set up to render continuous maintenance service, which is an important consideration in today's demand for speed and efficient operation.

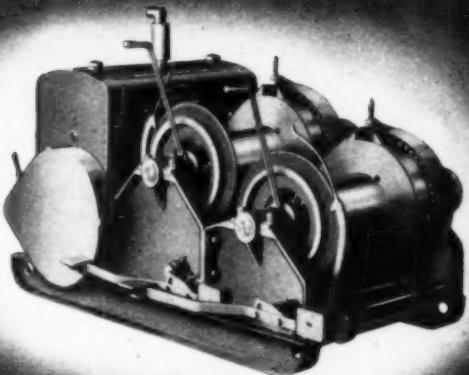
Contractors throughout the east are telling our field investigator how valuable they consider the service of the distributor. Nearly to a man they emphasize the importance of listing distributors and branch offices in manufacturers' advertising in Engineering News-Record and Construction Methods. They want to know how close they are to current jobs and to jobs in prospect. Such information is a help to them in estimating time and costs. The information obtained from these field interviews is being briefed in bulletins which are available to anyone who is interested.

[Have you ever given the distributor the opportunity to open up and show what he can do to solve your problems and speed up the job? Next time you get a contract try him out. If he isn't listed in the manufacturer's advertising in Engineering News-Record and Construction Methods, consult the classified section of his local telephone book under "Contractor's Equipment." **]**

★ ★

**SIMPLY
RUGGED
DEPENDABLE**

CONSTRUCTION
EQUIPMENT



A Few Sterling Users

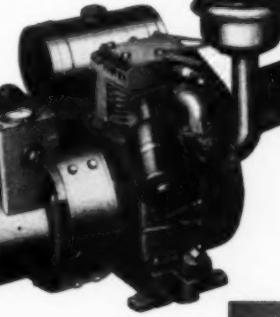
Raymond Concrete Pile Co. — Stone & Webster Engineering Corp. — Utah Construction Co. — Massman Construction Co. — Kansas City Bridge Co. — Pittsburgh-Des Moines Steel Co. — United Engineers & Constructors — Bilhorn, Bower & Peters, Inc. — Sinclair-Prairie Pipe Line Co. — Portland Bridge Co. — Wickham Bridge Co. — Addison Miller, Inc. — Spillway Builders, Inc. — Layne-Western Co. — Woods Brothers Construction Co. — W. A. Ross Construction Co. — American Bridge Co.

Checked 
by Leading Contractors

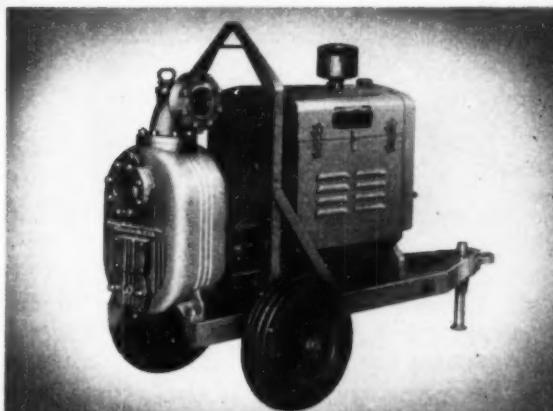
HOISTS 3 to 150 H.P. with Patented Improved Screw Thrust with Timken Roller Thrust Bearing and Positive Clutch Release — Johns-Manville Asbestos Frictions — High Carbon Ground Precision Shafts — Alemite-Zerk Lubrication — Cut Gears.

GENERATING PLANTS

300 to 50,000 Watts AC and DC. Fully Developed — Thoroughly Tried and Proven.



SAW RIGS Multiple V-Belt Drive. Efficient — Economical — Complete — Compact.



PUMPS

1 1/2" to 10" Self Priming Contractors Pumps — 4" to 12" Dredge Pumps — Single and Multistage Jetting Pumps — Well Point Pumps — Modern — Efficient — Dependable.

USED and RECOMMENDED
by Leading Contractors
Everywhere
Ask for Literature

Sterling
MACHINERY CORPORATION
411-13 Southwest Blvd. Kansas City, Mo.

WHEN IS A LOAD AN OVERLOAD?



JUST like old Dobbin, the bearings of your machines are frequently called upon to do extra work—carry overloads—without complaining or breaking down.

Even under normal loads, the thin film of lubricant must be plenty tough. And the greater the overload and the resultant higher temperatures, the greater your chances of scored bearings and costly shutdowns.

The lubricant you select, these days of rush jobs and heavy production schedules, has to be *right*.

Shell men have years of experience to back

them up, the best of crudes to work with, and the most modern research and refinery equipment in the world at their disposal. They have devoted their time to producing and applying lubricants that will do the daily job required of them *in your plant*, taking possible overloads and all other factors into consideration.

Call in your Shell man today. Give him your toughest lubrication problem and let him work it out for you. The odds are ten to one he'll save you money.



SHELL INDUSTRIAL LUBRICANTS



KOEHRING POWER — built into the shovel from engine to clutches, gears, and crowd—power that flows without loss or interruption to the digging dipper — is the "stuff" that counts to maintain high speed maximum production on day and night working schedules.

KOEHRING STRENGTH — built into the shovel to "take" the power — strength without a weak link — Heavy-Duty construction—from crawlers to dipper—is the quality required for high speed digging in all types of material. Dirt or rock, Koehring strength is digging strength.

Koehring equipment is noted for its quality and honest workmanship. Profits are made from working, not buying a shovel. Buy Koehring for working qualities and profit.

KOEHRING COMPANY MILWAUKEE, WISCONSIN

HEAVY-DUTY CONSTRUCTION EQUIPMENT





**FOR SPEED AND ECONOMY
USE
HIGH EARLY
POZZOLITH
WITH REGULAR PORTLAND CEMENT**

**SAVE YOUR TIME AND MONEY! USE THIS NEW,
EASY, ECONOMICAL WAY TO GET HIGH EARLY
STRENGTH CONCRETE—PREVENT WINTER SLOW-
DOWN—AND CUT COLD WEATHER COSTS—**

NOW—you can speed up your construction a new, easy, sure way, by adding at time of mix small amounts of HIGH EARLY POZZOLITH (in powder form) to regular portland cement *purchased at economical prices.*

NOW—you can save *easily* 4 to 5 days on each pour,—strip forms sooner,—and require fewer form sets.

NOW—it is easy and sure, using **HIGH EARLY POZZOLITH**, to have more accurate timing on quick-hardening slab work, and no trouble with flash sets.

NOW—using HIGH EARLY POZZOLITH,—you can get 3 day strength in one day,—7 day strength in 3,—and 28 day strength in 7 days. All this,—with less heat evolution, less shrinkage, less tendency to crack.

NOW—using **HIGH EARLY POZZOLITH**,—you can safeguard against cold weather freezing risks, and speed up the job.

REMEMBER—in addition to all these speed and money saving values, you get a denser, more durable concrete; increased placeability; increased durability; reduced bleeding, permeability, and absorption; also a reduction in your cement stocks,—all famous, longtime, money-saving values of Pozzolith, known throughout America.

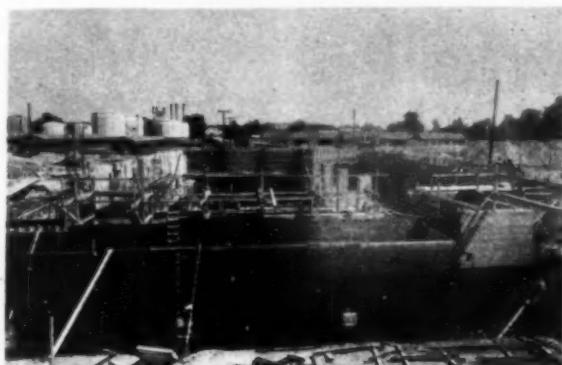
NOW—investigate this NEW, EASY, ECONOMICAL WAY to save your money, your time,—and insure excellent concrete. Send for the latest literature,—or shall we have a field representative call?

THE MASTER BUILDERS CO., LTD.

In the U.S.A.: The Master Builders Company, Cleveland, Ohio



POZZOLITH USED IN—Dam Bulkheads of St. Maurice Corp., La Tuque, Quebec. Architect and Contractor—Shawinigan Engineering Co., Montreal, Quebec.



POZZOLITH USED IN—New Owensboro Waterworks, Owensboro, Ky. Engineer:—Black & Veatch Engrs. Co., Kas. City, Mo. Contractor:—Engstrom & Wynn, Inc., Wheeling, W. Va.



POZZOLITH USED IN—Disposal Plant, Rock Island, Ill. Engineer:—Consoer, Townsend & Quinlan, Chicago, Illinois. Architect:—W. Gallagher, Rock Island, Illinois, Contractor:—Stark Construction Co., Cedar Rapids, Iowa.

MASTER BUILDERS

SPEEDING UP U. S. NAVY AIRPORT CONSTRUCTION



HERE one mile equals fifteen. This Normal Duty Barber-Greene Mixer is mixing sand asphalt for runways over 300 feet wide and 6" thick. There's a big job to be done, and the Barber-Greene is doing it with speed, economy, and perfection. Rated at $1\frac{1}{4}$ to $1\frac{3}{4}$ yards per minute in the B-G Catalog, this Normal Duty Model 848 is consistently mixing 3 cubic yards per minute of loose material on this job, not only speeding up construction, but meeting rigid Navy inspection.

Its ability to handle any bituminous or stabilizing job, in either Travel or Central Plant operation, its portability, high capacity, and thoroughly earned reputation for accurate proportioning and thorough mixing deserve your investigation. The B-G Mixer Book explains and illustrates its many outstanding features. Write for your copy. There is no obligation.

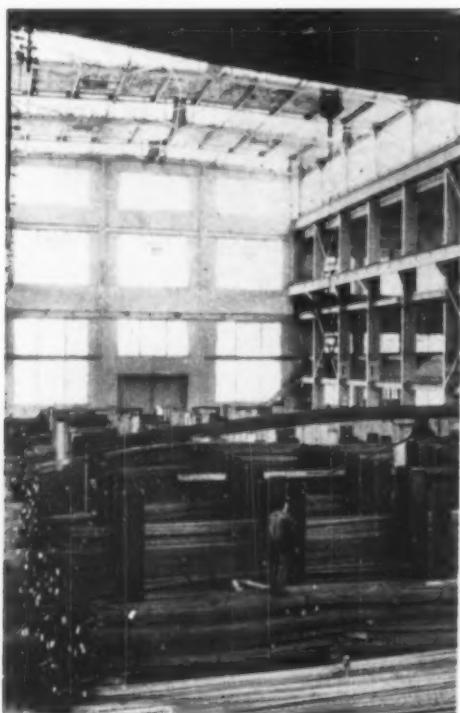
40-14

BARBER  **GREENE**
AURORA ILLINOIS

STANDARDIZED
MATERIAL HANDLING
MACHINES

REINFORCING STEEL

completely fabricated at Bethlehem warehouses



Unloading reinforcing steel in Bethlehem warehouse.



Shearing reinforcing bars in Bethlehem warehouse.



Fabricating bar mats in Bethlehem warehouse.



Each one of Bethlehem's fifteen reinforcing-steel warehouses maintains a shop equipped to fabricate steel for the job and according to requirements.

If you need standard reinforcing bars cut to length; if you need bars bent; if you need bars coiled or spiraled for

concrete construction, Bethlehem warehouse shops can efficiently handle the complete job.

Bethlehem reinforcing steel warehouses are located in all important construction centers so that prompt shipments can be made to any project site.

BETHLEHEM STEEL COMPANY
General Offices: Bethlehem, Pa.

Warehouses: Atlanta, Baltimore, Boston, Buffalo, Chicago, Danville, Detroit, Johnstown, Pa., Los Angeles, New York, Philadelphia, Pittsburgh, St. Paul, San Francisco, Seattle.

BETHLEHEM STEEL COMPANY



offers you a complete line of
tractor equipment . . .



This is the most complete line of tractor equipment available from any single manufacturer.

Included are: 4-Wheel Scrapers with 2-line cable control, in sizes from 4 to 13 yards struck measure. Single and double-drum Power Control Units. Hydraulic, 2-Wheel back-dump Scrapers, in sizes from 2½ to 7 yards struck measure. Hydraulic Bulldozers and Bullgraders to fit all International TracTractors. Cable-operated Bullgraders and Bulldozers to fit TD-14 and TD-18 TracTractors.

Grubbers to fit TD-18 TracTractors.

Single, double, and triple-drum Tamping Rollers. Cable-operated Rippers and Rotary Rippers. Cabs to fit TD-14 and TD-18 International TracTractors equipped with Bucyrus-Erie Bullgraders, Bulldozers or Snow Plows. And Snow Plows to fit International TD-40 and TD-14 TracTractors.

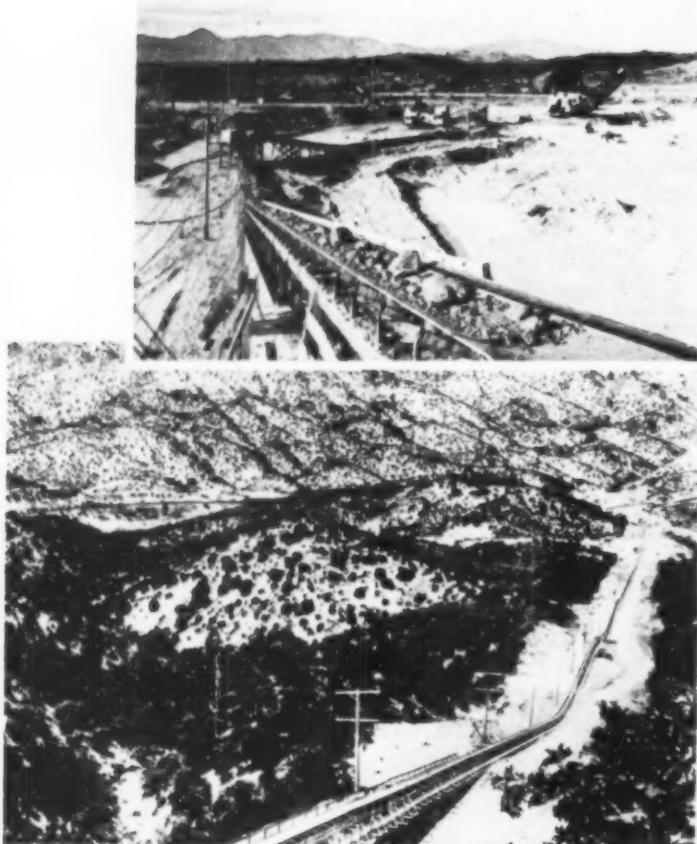
Get in touch with your nearest International TracTractor distributor for complete details on all these outstanding Bucyrus-Erie tractor equipment units.

Bucyrus-Erie
SOUTH MILWAUKEE, WISCONSIN

HIGHER THAN GRAND COULEE--

SHASTA DAM

**California's Mighty Effort
to Curb Floods and Furnish
Water for Irrigation**



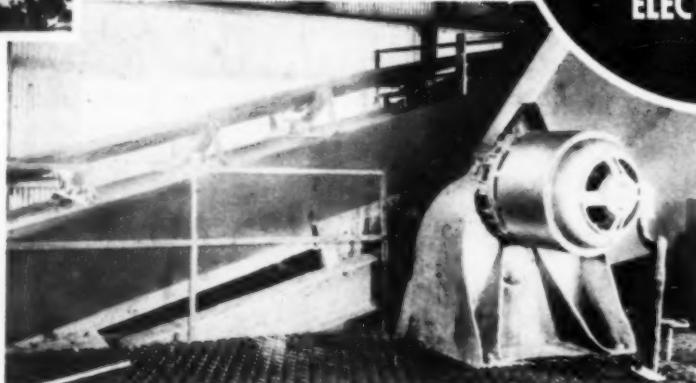
The start of the 9.6-mile conveyor system. Aggregate is carried from Redding, Cal., to the dam site over rivers, highways, and mountains.

(Right) One of the twenty-six 200-hp motorized speed reducers which keep the conveyor moving — night and day.



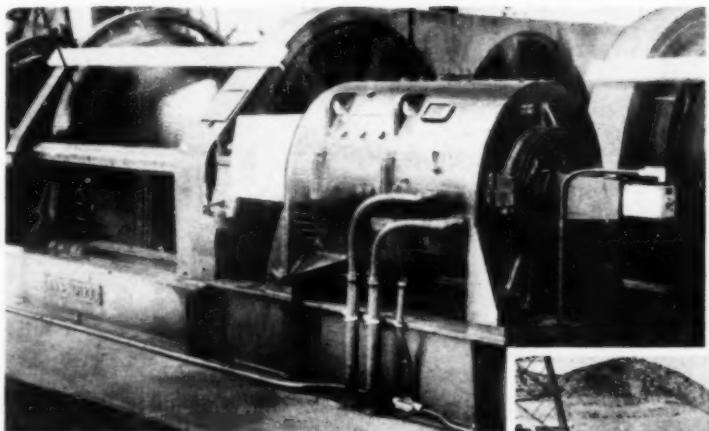
Note how the 460-ft take-off tower for the seven Lidgerwood cableways dwarfs the mixing plant at its base. Three of these cableways use G-E variable-voltage drive to save money by means of faster round trips.

YOU CLEAR A
BIGGER NET
WHEN YOU OPERATE
ELECTRICALLY



BIGGER THAN BOULDER--

Starts to Rise



One of the three money-saving G-E 450-hp variable-voltage drives. By speeding up the return trip of the bucket, these drives reduce operating time by 17 seconds for each trip, and thus save thousands of dollars.

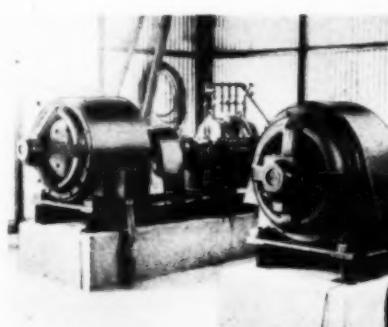
In the shadow of the huge cableway, the first of 750,000 eight-yard buckets was poured in July, 1940.



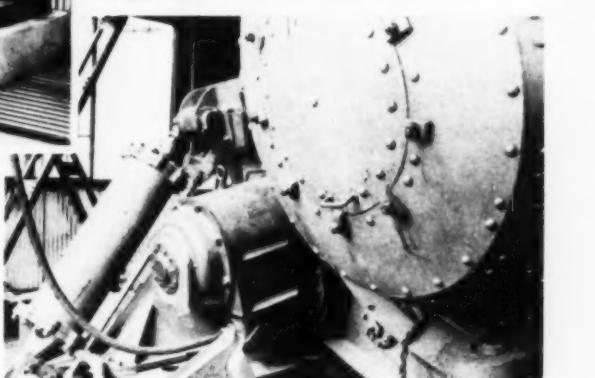
SHASTA DAM—largest unit in the \$170,000,000 Central Valley Project—which will be the highest over-flow type dam in the world!

The building of this enormous dam is marked by several revolutionary developments. One is Columbia Construction Company's 9.6-mi. conveyor system—the world's longest—to carry aggregate to the dam from Redding, Cal. Another is the use of one main tower for seven cableways—an ingenious method devised by the contractor, Pacific Constructors, Inc., to pour the six million yards of concrete needed. Both these money-saving innovations rely on properly applied G-E equipment for their success. All the main conveyor drives and the heaviest-capacity cableways are G-E equipped.

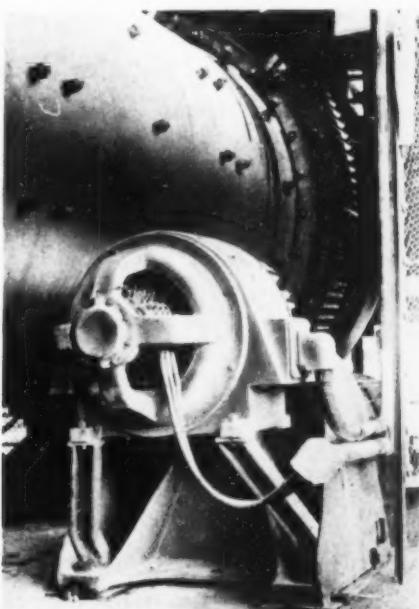
Without the right electric equipment, correctly designed and co-ordinated, it would be impossible to profitably carry out these vital construction projects. Before you start on your next job, why not call in our skilled engineers? They can help you, too, save days and dollars electrically. General Electric, Schenectady, N. Y.



Two G-E squirrel-cage induction motors, each coupled to a centrifugal pump for forcing water to tanks high above the construction camp.



A G-E flange-mounted, splashproof induction motor, specially designed for this job, driving a concrete mixer.



A 200-hp G-E wound-rotor motor drives the tubular gravel scrubber through which will pass the gravel for the six miles of concrete. This is reported as being the world's largest single-unit motorized reducer.

GENERAL ELECTRIC

655-16



ALTER EGO: Literally "one's other self"—the still, small voice that questions, inspires and corrects our conscious action.

ALTER EGO: How many have offered you a "good-as-Fleetweld" rod . . . and are they confessing or bragging?

Well, here's the third different welding rod proposition that lays eloquent emphasis on the claim that it's as good as "Fleetweld." That's stimulating.

ALTER EGO: No, it's emulating. Emulation admires and strives to imitate great actions. It's a human trait.

That prompts me to ask myself—"Why is 'Fleetweld' taken as the standard of welding electrode comparison?"

ALTER EGO: Maybe Lincoln can give us the FACTS and we can judge for ourselves.

• •

LINCOLN SUGGESTS: To find out why "Fleetweld" is the standard of comparison for welding quality and economy, TRY IT! Compare it to other electrodes. In what ways? See the 30-Point Check Chart on Page 5 of the New "Weldirectory." This 56-page procedure guide (gratis) gives all the FACTS about 37 Lincoln Electrodes for welding and hard-surfacing—where to use them—how to use them—what weld properties to expect.

LINCOLN "SHIELD-ARC" WELDING THE LINCOLN ELECTRIC COMPANY
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The P&H Model 255 ($\frac{3}{4}$ -yd.) with tractor type crawlers, gives you travel speeds up to $2\frac{1}{2}$ miles an hour. It gives you a change of pace in digging, too, with 3-speed transmission to answer every need for power in soft soil or toughest clay.

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1. **Dependable equipment** protects you against frequent breakdowns, time losses, and repair bills. Built with tough alloy rolled steels, P&H excavators have reduced these profit hazards to a new minimum.

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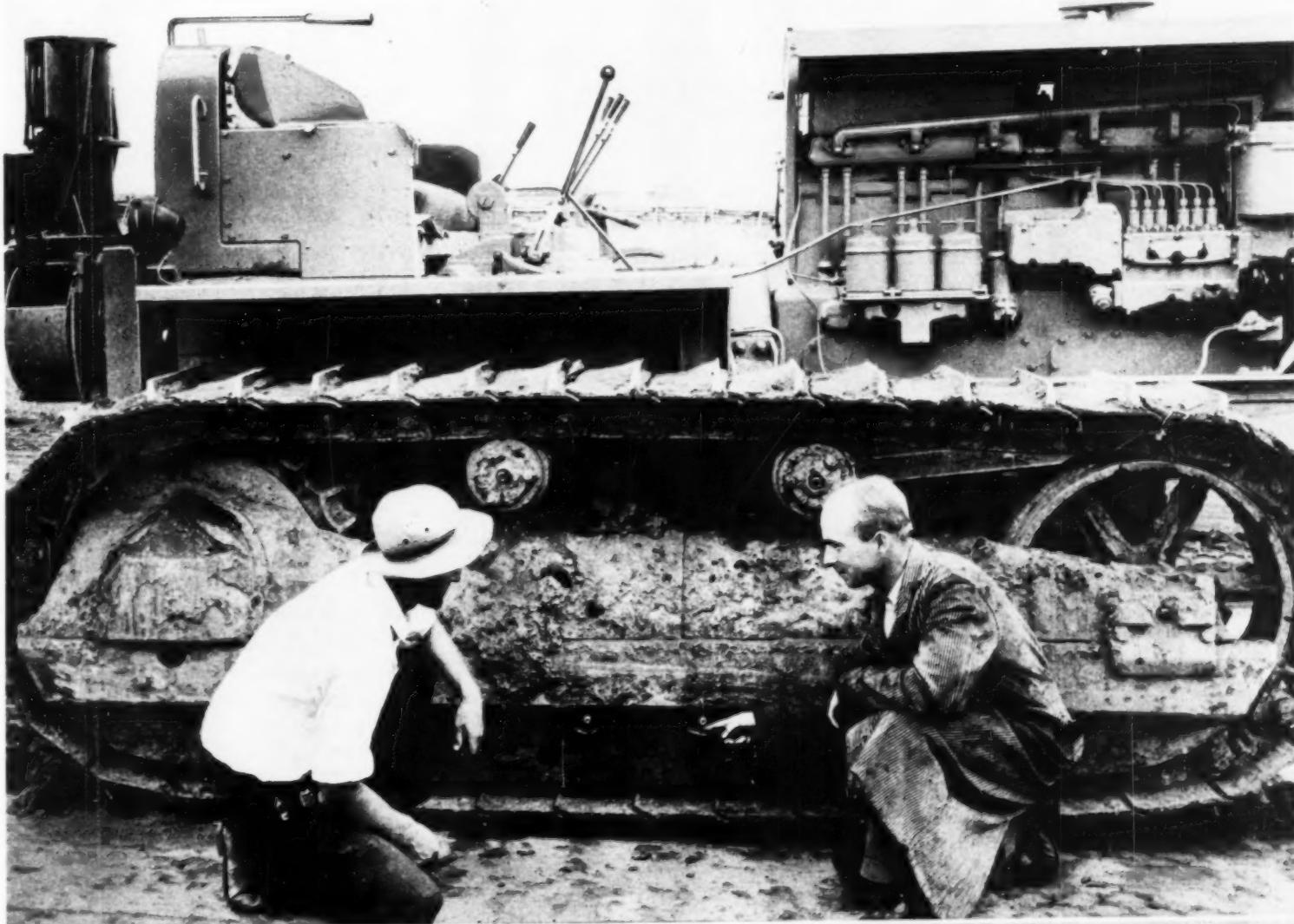
Under these conditions it is not surprising a track roller has a short life and not a merry one, unless it is thoroughly protected by the right lubricant.

A North Dakota road contractor was using a conventional transmission grease on his track rollers and using too much, he thought. In spite

of his careful attention, he felt that track rollers weren't standing up as they should. Just to be sure, he asked a Standard Automotive Engineer for his recommendation. It proved to be a very good "hunch". When the Engineer inspected the rollers and put on the right grease, maintenance dropped 10%, with 12% less grease needed.

If you operate gasoline or Diesel powered equipment, "play this hunch" and have a Standard Automotive Engineer look it over. It won't cost anything. Just write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago, Illinois and ask for the Engineer nearest you. In Nebraska, write Standard Oil Company of Nebraska at Omaha.

Copr. 1940, Standard Oil Co. (Ind.)

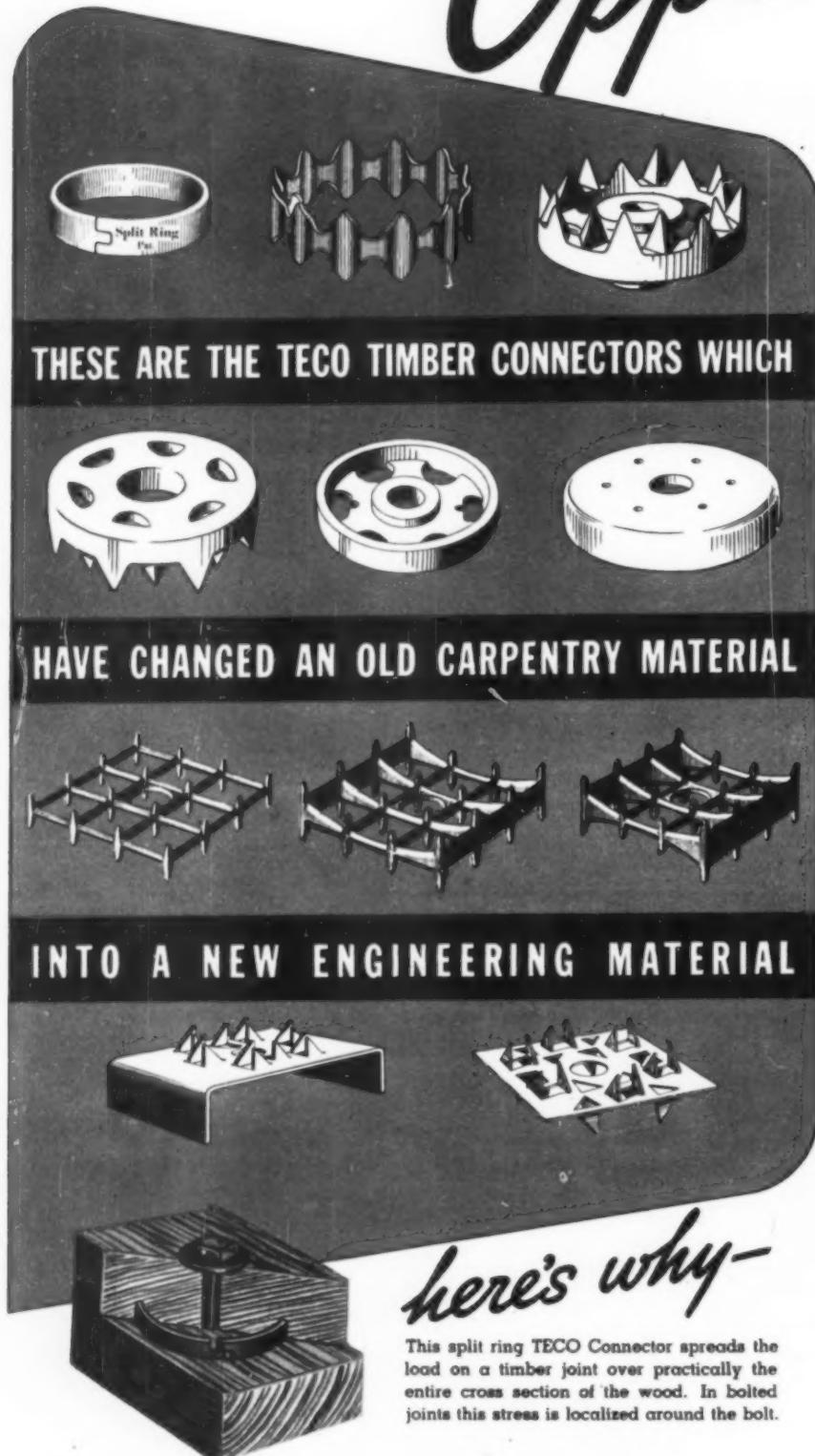


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INTO A NEW ENGINEERING MATERIAL



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This split ring TECO Connector spreads the load on a timber joint over practically the entire cross section of the wood. In bolted joints this stress is localized around the bolt.

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RANGE of STRUCTURAL
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These Teco Timber Connectors make low-cost timber construction applicable to a great many new types of work.

THESE ARE THE TIMBER CONNECTORS which cut costs through the elimination of over-design in timber structures . . . they do away with most of the bolts, plates and angles formerly associated with heavy construction.

THESE ARE THE CONNECTORS which decentralize the stresses in timber joints . . . one $\frac{1}{2}$ " bolt and one $2\frac{1}{2}$ " Teco Split Ring often produce a stronger connection than six $\frac{1}{2}$ " bolts.

THESE ARE THE TIMBER CONNECTORS which have been responsible for the recent tremendous expansion of facilities for shop fabrication of timber parts.

THESE ARE THE TIMBER CONNECTORS which have established a new set of engineering principles applied with conspicuous saving to nearly 30,000 CCC housing units, towers, trestles, piers, wharves, bridges, warehouses and dry docks within the last seven years.

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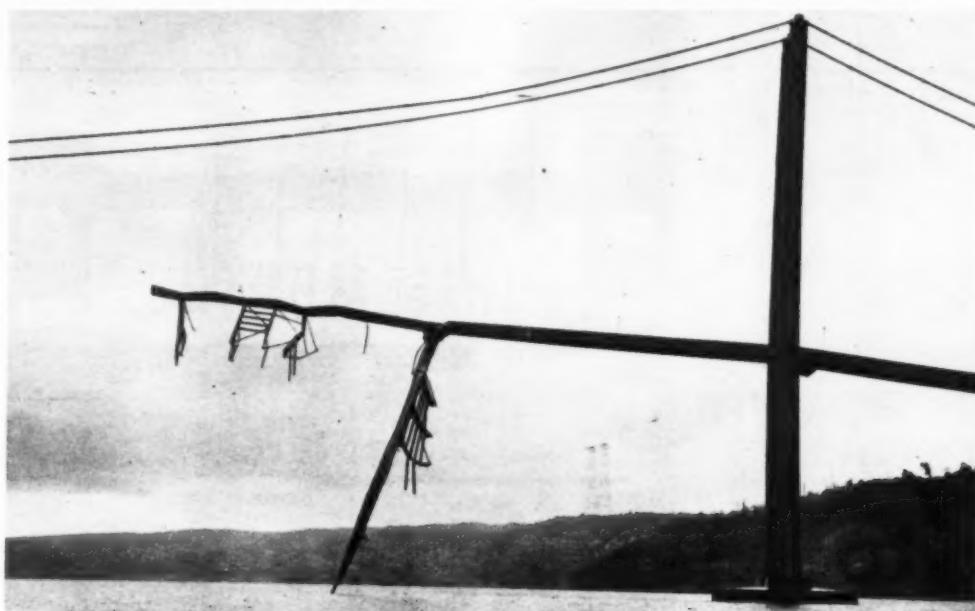
Construction Methods

ROBERT K. TOMLIN, Editor

Volume 22

DECEMBER, 1940

Number 12



BUCKLED STEELWORK supporting 39-ft. wide roadway of 2,800-ft. main suspension span of Tacoma Narrows bridge plunges into Puget Sound.

WRACKED AND TWISTED by the force of a 42-mi.-per-hour wind, the narrow (39 ft.) roadway on the 2,800-ft. main span of the new Tacoma Narrows suspension bridge in Washington buckled, broke and fell into Puget Sound at noon Nov. 7. No lives were lost and the 425-ft. steel towers and main suspension cables remained in place. The two 1,100-ft. side spans sagged 30 ft. but did not collapse. Release of tension on the cables by the collapse of the central span caused the tall steel towers to bend backward 12 ft. under the pull of the side spans.

Prior to failure the force of the wind on the long, slender bridge had developed an oscillating or "weaving" motion which tilted the normally horizontal deck sideways as much as 45 deg. and also created vertical "waves" of more than 4-ft. amplitude, in the roadway. Failure is believed to have begun near the center of the main span with the buckling of the 8-ft. deep stiffening girders and lateral bracing, followed by

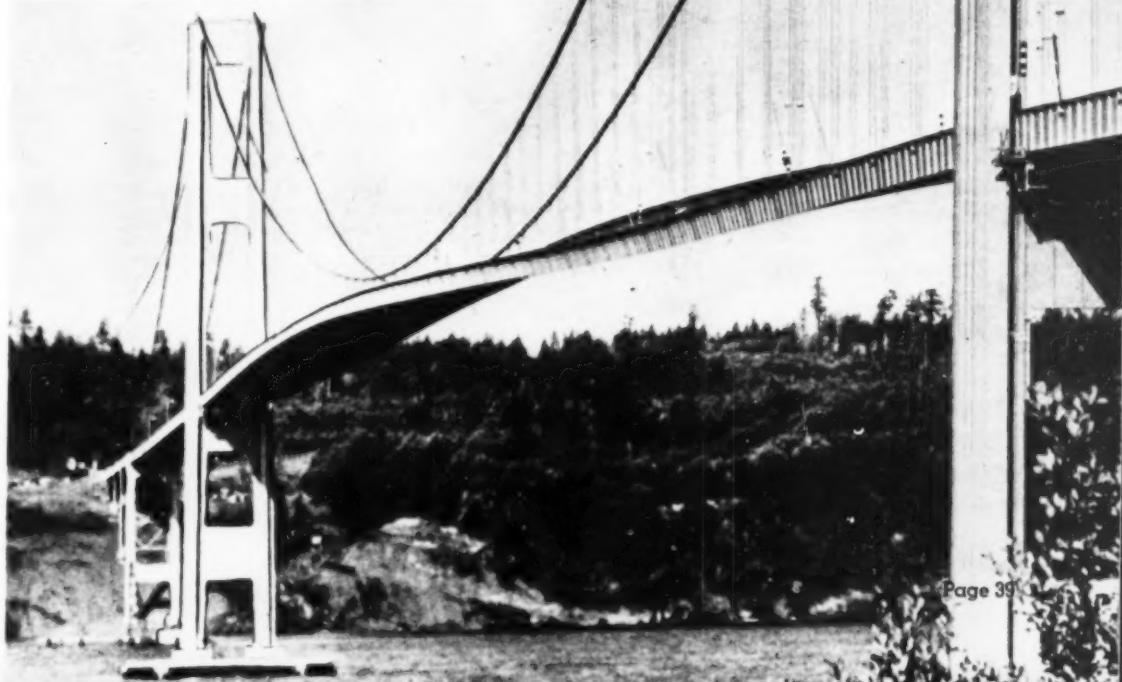
the snapping of the vertical suspender cables.

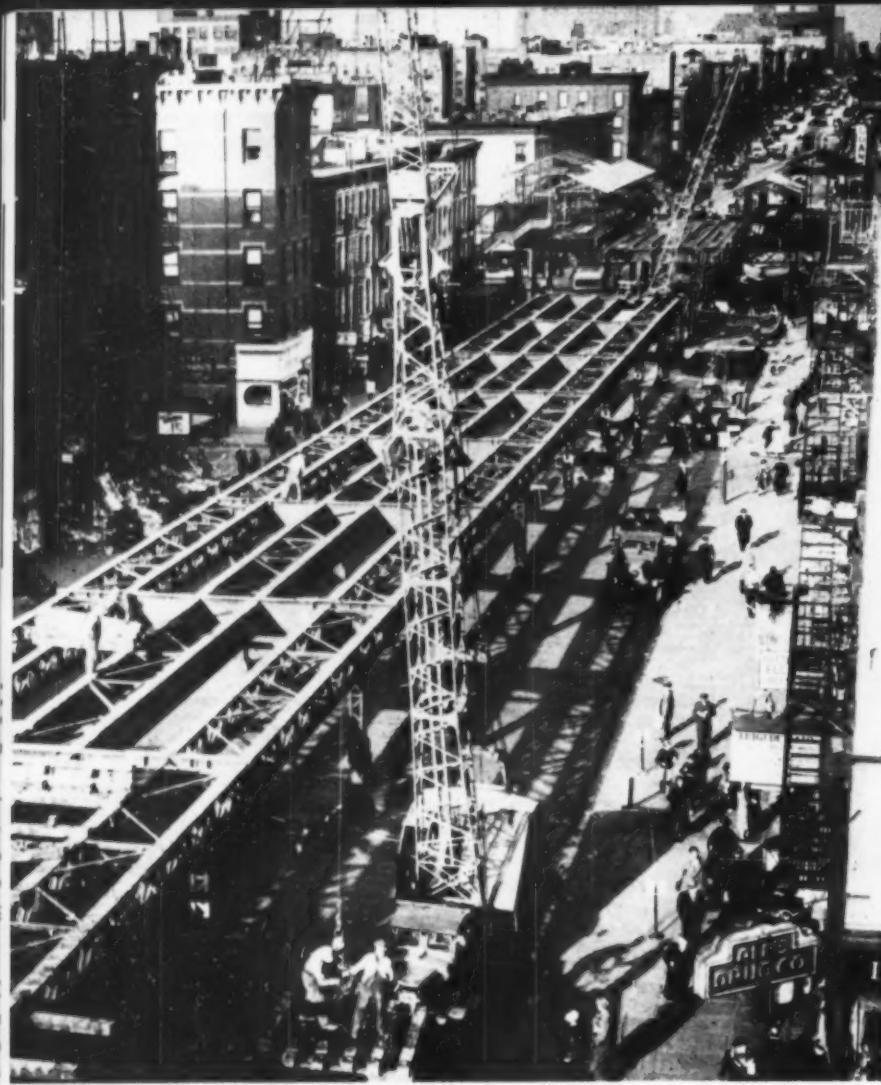
The bridge, third longest cable suspension span in the world, carried two traffic lanes, was placed in service last July and was built at a cost of \$6,400,000 by the Washington Toll Bridge Authority.

WIND FORCES *Wreck Roadway* OF TACOMA BRIDGE

"WEAVING" ACTION of bridge (below) in 42-mi. per hour wind is clearly shown in this photograph. Lateral rocking tilted deck as much as 45 deg. and created vertical "waves" in the roadway with an amplitude of more than 4 ft.

Wide World Photos





RAZING OF ELEVATED RAILROAD along Ninth Ave., New York City, proceeds at rapid pace as crews of Albert A. Volk Co., Inc., specialists in demolition work, cut steelwork with oxyacetylene torches and handle scrap into trucks with crawler cranes.

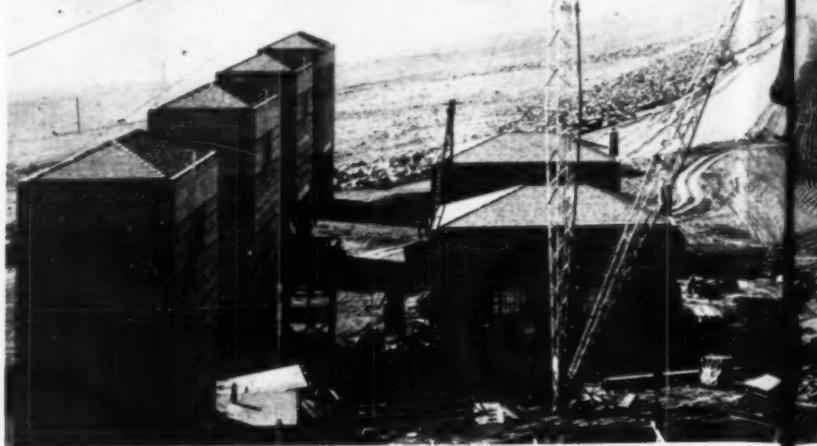
H. A. Wurgel Photo

GROUND BREAKING CEREMONIES (below) for \$80,000,000 Battery vehicular tunnel under East River between lower Manhattan and Brooklyn are held Oct. 28 as President Roosevelt gives signal for removal of first bucketful of earth at Brooklyn shaft. Subaqueous twin tubes with lining of cast-iron rings, will be built under supervision of New York City Tunnel Authority.

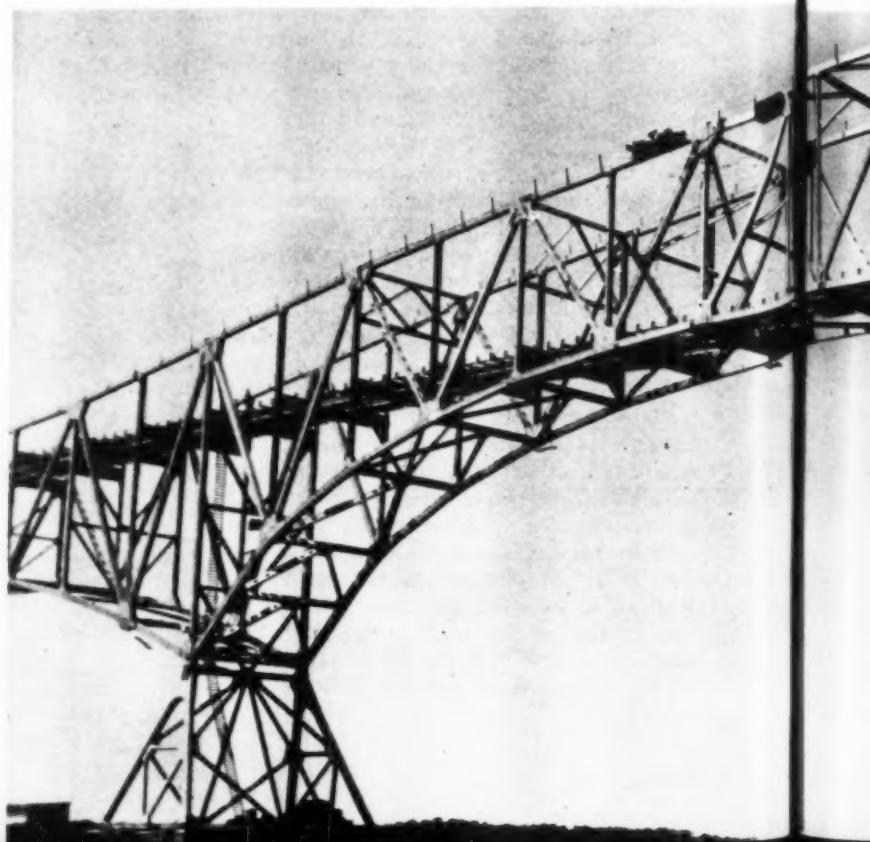
Wide World Photo



LARGEST EARTH FILL DAM ever constructed is nearly finished at Fort Peck, Mont., by U. S. Engineer Department. On Oct. 11, J. A. Terteling & Sons moved last yard of material for topping out huge structure across Missouri River. Dam 250½ ft. high and 2 mi. long across river valley, is 3,500 ft. wide at base and contains 122,700,000 cu.yd. of earth fill of which all but 540,000 cu.yd. were placed hydraulically.



THIS MONTH'S NEWS REEL





AT CHEROKEE DAM on Holston River 35 mi. northeast of Knoxville, Tenn., construction of wood cribs for cofferdam is started by crews of Tennessee Valley Authority. Dam, when completed, will be 6,750 ft. long and 175 ft. high. It will contribute to TVA flood control and navigation program and will generate hydro-electric power for national defense industries.

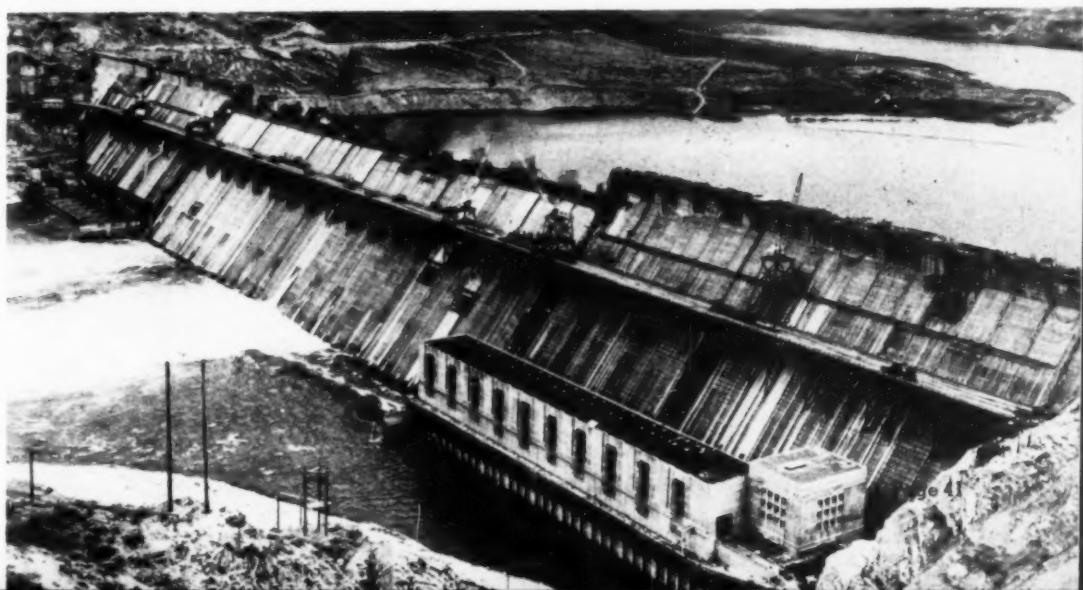


NEW AIRCRAFT ENGINE FACTORY for Curtiss-Wright Corp. near Cincinnati, Ohio, to cost \$37,000,000, is scene of preliminary construction operations Oct. 23, as Allis-Chalmers diesel tractor equipped with bulldozer breaks ground for 35-acre plant to expand production facilities for national defense. Seated on tractor are (left to right): Brig.-Gen. O. P. Echols, commanding officer at Wright Field, Dayton, Ohio; Emil Schram, chairman, Reconstruction Finance Corp.; and Guy W. Vaughan, president, Curtiss-Wright Corp.



QUEENS-MIDTOWN TUNNEL, \$58,000,000 twin-tube vehicular route under East River between Manhattan and Long Island City, is opened to traffic Nov. 15 by New York City Tunnel Authority. Built by Walsh Construction Co., each of two 31-ft.-diameter tubes has two-lane 21-ft. roadway paved by W. J. Fitzgerald, New York contractor, with de-aired brick on an asphaltic-mastic cushion course.

NEARING COMPLETION (below) is U. S. Bureau of Reclamation's Grand Coulee dam on Columbia River, Washington. Power house, in spite of its length of two city blocks, is dwarfed by huge concrete body of main structure, built by Consolidated Builders, Inc. In central section 10 piers will support roadway across spillway.



CANTILEVER SPAN, 800 ft. long, of new bridge utilizing Wichert trusses and girder spans, reaches out over Potomac River between Ludlow Ferry, Md., and Dahlgren, Va. Structure with total length of 10,050 ft. between abutments, designed by J. E. Greiner Co., of Baltimore, Md., for Maryland State Roads Commission, was recently completed by Harris Structural Steel Co., of New York City. Final closure of main channel span was made with aid of two 300-ton jacks per truss.

LINE CONSTRUCTION METHODS FOR *Rural Electrification*

By GUY W. THAXTON
Chief Construction Engineer,
Rural Electrification Administration,
Washington, D.C.

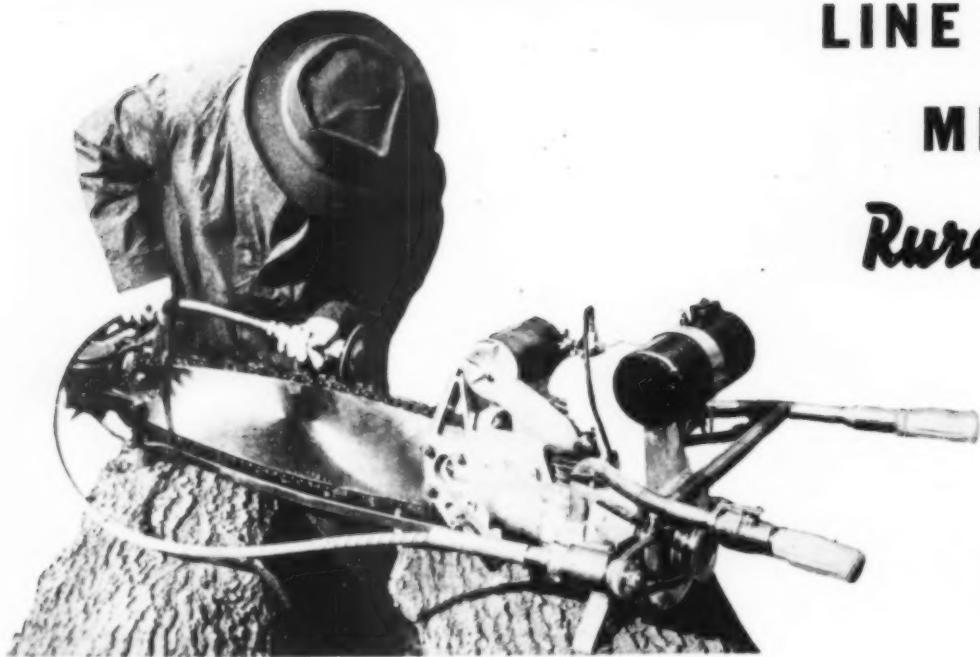
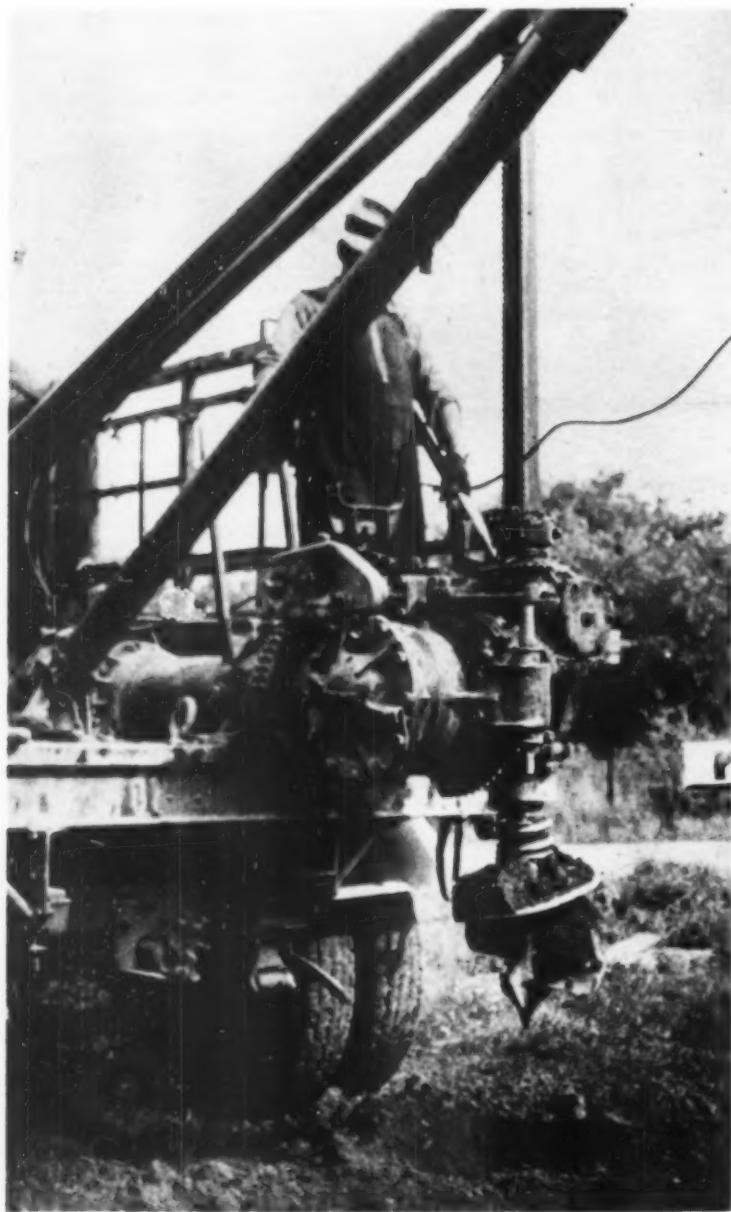


Fig. 1 . . . POWER-DRIVEN SAW, equipped with sharpening device, is useful in clearing right-of-way for line construction. This Mall chain saw, driven by 2-cycle gasoline engine, can cut logs into lengths for convenient handling in areas where large-trunked trees must be removed.

PRIOR TO THE BEGINNING of the Rural Electrification Administration program, electric transmission and distribution lines were built almost exclusively by the construction crews of electric service companies or by forces supplied by engineering or management concerns affiliated with service companies. Only a very small percentage of such lines were constructed under contract by independent contractors. Under the



Figs. 2 and 3 . . . POST HOLE DIGGERS, power-operated, are widely used by contractors on line construction. Depending upon local conditions both truck mountings (left) and tractor mountings (right) for boring equipment are employed.

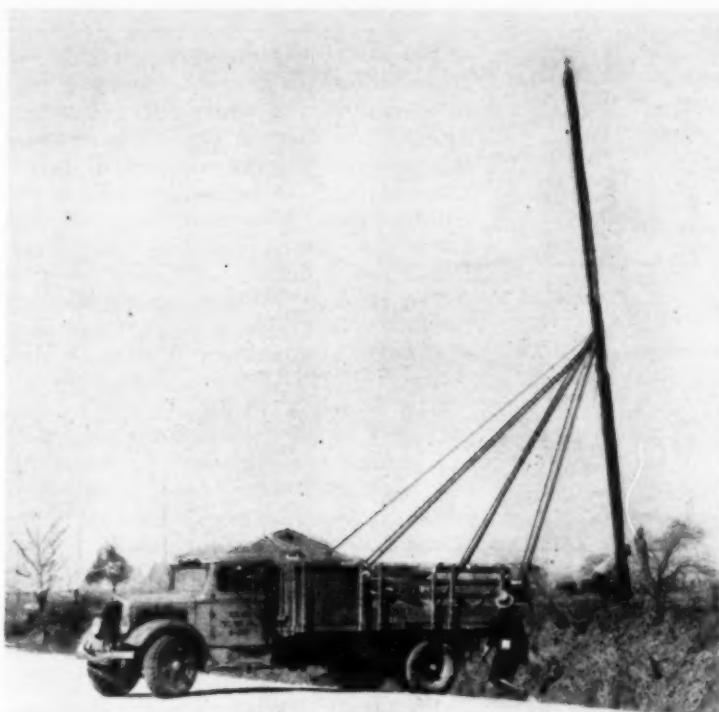


Fig. 4 . . . **POLE ERECTION** is commonly handled by some form of A-frame mounted on rear end of truck or on tractor.

stimulus provided by the REA program, this situation has materially changed, resulting in progressive improvement in construction methods. The Rural Electrification Administration is proud of the part it has played, and is still playing, in bringing about this improvement. Particularly should it be noted that the economies effected thereby have resulted in such lowering of construction costs as to make feasible the extension of electric service facilities to previously unserved rural areas, where that service could never have been supplied feasibly before. The methods and machines briefly discussed herein are some of those which have been adopted or perfected for use in the program.

With the opening up of this program a call was sent out for electrical contractors and general contractors to bid on



Fig. 5 . . . **SPINDLE OF POST HOLE DIGGER**, mounted on tractor, serves as gin-pole for erection of wood poles to carry electric lines.



Fig. 6 . . . **COUNTERWEIGHTED CRANE BOOM** on rubber-tired wheel tractor, raises and sets poles in holes excavated by post-hole diggers.

the construction of the new projects. There were at that time, however, very few such concerns which were experienced in the building of electric lines. Of those with previous experience not all were equipped with the necessary machinery and tools. In 1936 a few general contractors were attracted to REA work, but it was not until 1937 that the volume of construction became large enough to interest many of the larger firms. The rapid expansion of the program necessitated improved and more rapid methods of operation. Power-driven equipment offered a partial answer to this and various improved machines began to appear in different parts of the country. Long-span construction, as advocated by the REA, makes mobility of equipment a most important consideration.

Clearing Right-of-Way

Clearing of right-of-way constitutes a phase of line construction that is variable in cost; for this work, therefore, proper equipment is essential. Two types of power-driven saws have been adapted for this use, depending on the nature

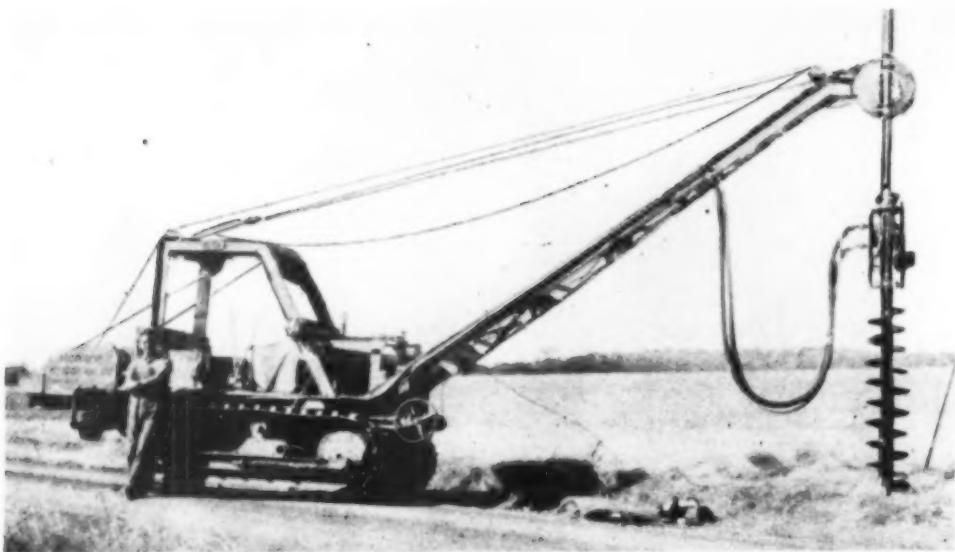


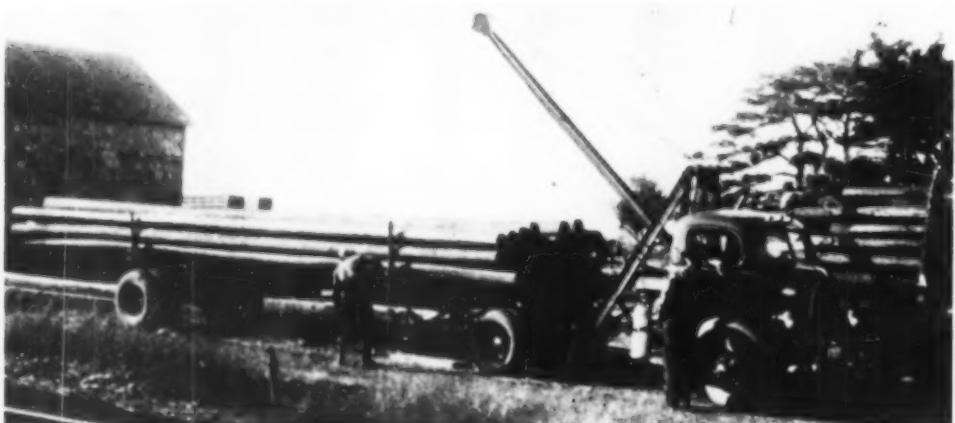
Fig. 7. HYDRAULICALLY-DRIVEN HOLE DIGGER mounted on tractor has boom that can be quickly brought into position without careful aligning of tractor.



Fig. 8. WHERE ROCK IS ENCOUNTERED drilling for post holes is done by jackhammer served by air compressor mounted on truck



Figs. 9 and 10. HANDLING OF WOOD POLES is done by use of wire rope slings (left) by boom mounted on truck which hauls long trailer (below)



of the work to be done. A power-driven crosscut saw, designed for cutting logs into lengths for convenient handling, (Fig. 1) is used in areas where there is a relatively large number of large-trunked trees to be removed from the right-of-way. This same type of saw can also be used for sawing down trees, but is not generally employed for that purpose. In the midwestern states, particularly Nebraska, Kansas, Oklahoma, and parts of Missouri, it is often necessary to cut Osage orange hedge, which forms a thorny, dense growth and is utilized by the farmers as fences. A circular saw, mounted on a vertical shaft, seems well adapted to this type of work, since it can more easily be brought into position against the close-growing hedge trees than a crosscut saw.

One of the first of this type of saws to be used for hedge cutting was designed and constructed for use by one of the power companies in the Midwest. It lacked the present-day refinements, was mounted on a heavy frame, powered by a secondhand Model T Ford motor, and pulled by a tractor. Models in use now are more efficient and more conveniently arranged. One very compact type of power-drive circular saw is designed to be mounted on the side of a tractor. A 16-in. disk has proved to be a very good size for use on hedge. When mounted on one of the newer model, rubber-tired tractors, with a road speed of 15 to 18 m.p.h., it is found to be a very serviceable piece of equipment. Most of these saws are adjustable, to the extent that a hedge may be cut anywhere from a few inches to about 4 ft. above the ground line. This is advantageous for the reason that many of these hedges were planted to serve as fences and often the land owner desires to have the hedge cut so that it will still serve as a fence.

Digging Post Holes

One notable addition to the equipment of many of the contractors was the power-driven hole-digger. Such machines were not new in principle, for the industry had made use of many designs, on various types of carriages, for a number of years prior to the organization of REA. Hole-diggers mounted on trucks (Fig. 2) are used to a good advantage where the terrain is suited to truck travel. Along open roads or across open land somewhat greater efficiency is achieved with equipment mounted on trucks than with that mounted on tractors. The advantage of tractor-mounted equipment (Fig. 3) is that there are fewer inaccessible places. The use of the truck, under conditions favorable to truck travel, will result in about 15 per cent more completed work for any given time than when a tractor is used.

In the handling of the smaller sizes of poles, such as predominate in REA work, it is often possible to set them

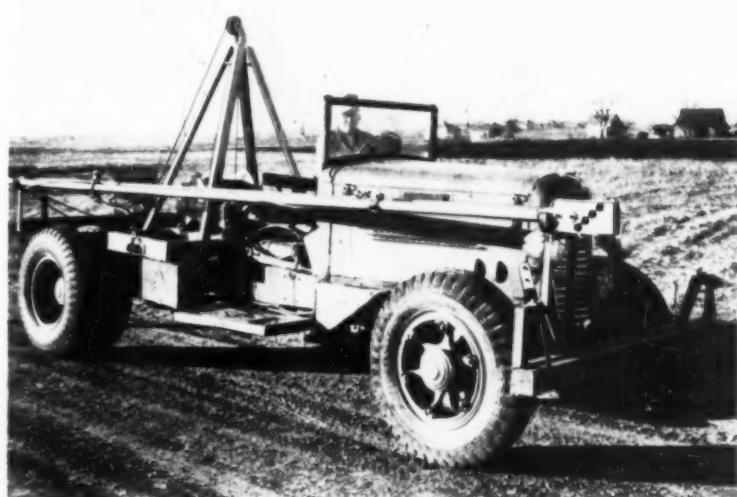
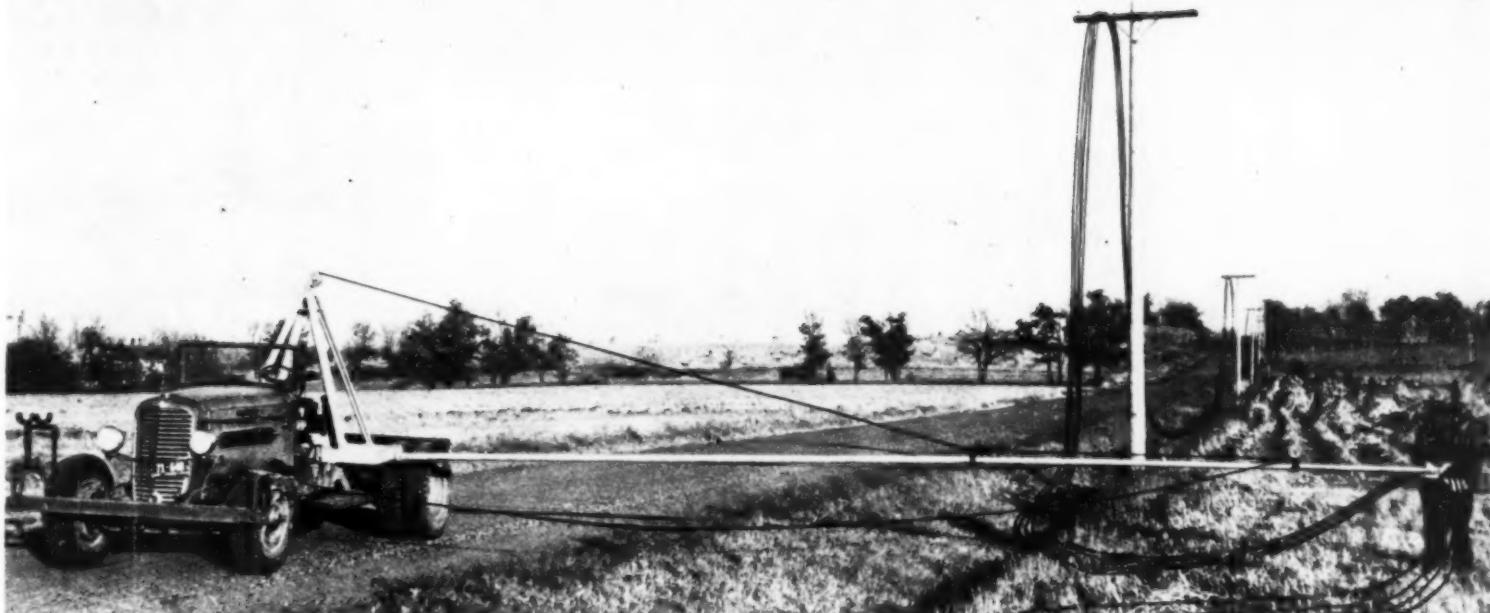


Fig. 11 . . . FOR STRINGING WIRES on poles special rig proves effective. This Dorco "mechanical lineman" consists of motor truck equipped with power takeoff winch, tower, boom and guy cables. Wires laid out along route (top) are strung into "mechanical hand" on end of boom lowered into horizontal position. Boom is then raised by winch (left, below) to carry wires into position on cross-arms of poles. For travel on road (right, below) it is disassembled into compact unit. Boom is of telescopic steel tubing and is adjustable as to length from 32 to 40 ft.

in the holes with the same machine that is used for digging the hole. By use of a small A-frame, with proper attachments, mounted on the frame of the tractor or on the bed of the truck, (Fig. 4) the pole can be raised with two or three men supplying the necessary hand power to place it in the hole. This combined operation of dig-

ging the hole and placing the pole with the one machine often results in considerable savings to the contractor, in both time and money.

A similar development of equipment of this nature is one having the housing of the shaft of the hole-digger of sufficient height and strength to support the weight of a pole. Fig. 5 illustrates how

conveniently this improvement works in handling lightweight poles. Another type of pole-setting rig, with counterweighted boom on a wheel tractor, is illustrated in Fig. 6.

A type of hydraulically-driven hole-digger has been used with considerable success by some contractors; Fig. 7

(Continued on page 76)

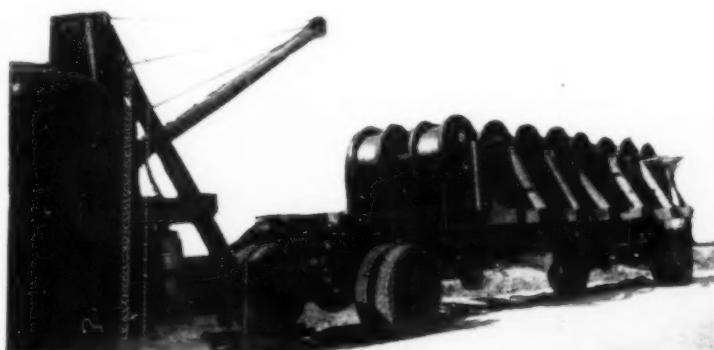
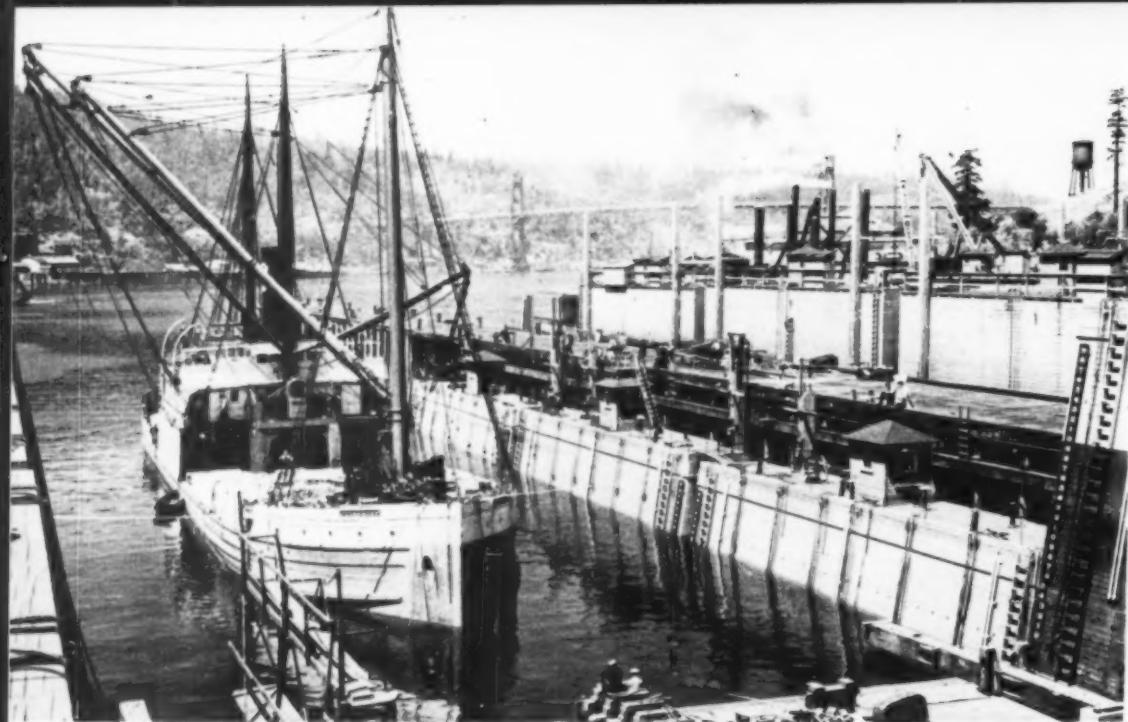


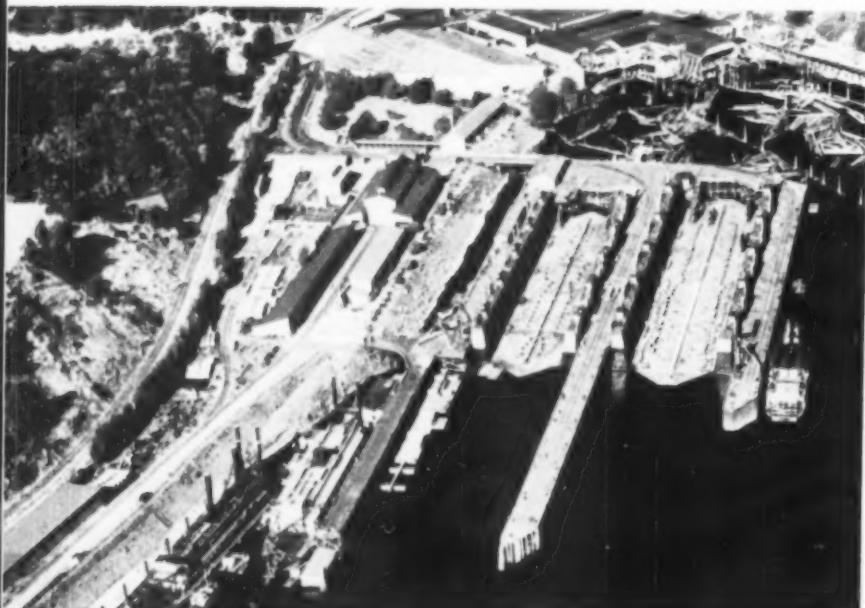
Fig. 12 . . . MULTIPLE-REEL TRUCK for wire stringing operations reduces delay occasioned by need of reloading reel trucks in field.



Fig. 13 . . . STRINGING OF WIRES is facilitated by truck and trailer carrying reels.



REBUILT DRYDOCK receives damaged coast-wise lumber vessel, requiring sinking of only six of ten wood towers, carried on pontoons, to lift boat of this size.



PORLAND'S TWO DRYDOCKS. of which one at right has been rebuilt to serve ocean vessels calling in Columbia and Willamette Rivers.

INTERIOR OF DRYDOCK (below). measuring 126x450 ft., shows deck of floating pontoons, with blocking arranged to dock steamer, and eight of ten 38-ft. high towers, or sidewalls, rebuilt of Wolmanized lumber to withstand effects of periodic immersion.

DRYDOCK REBUILT WITH *Prefabricated Lumber*

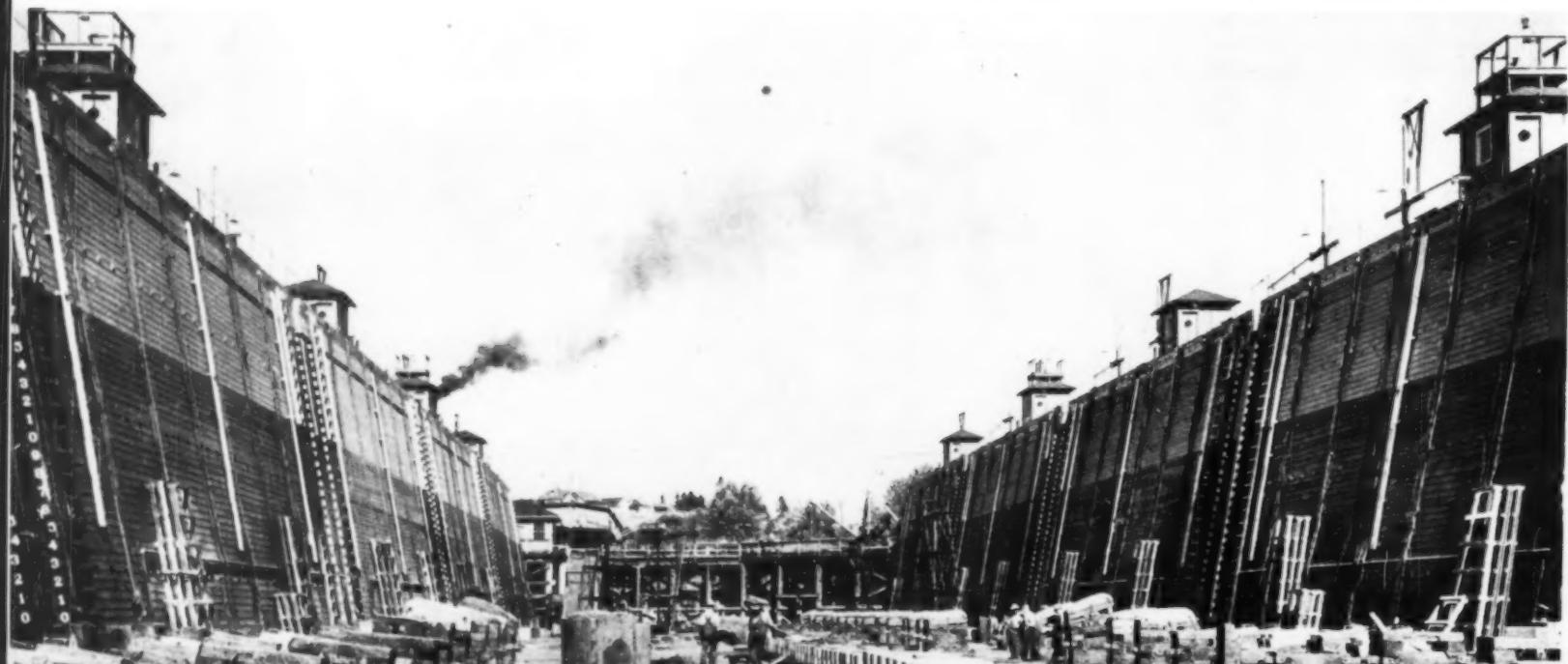
ADAPTABILITY OF LUMBER to prefabrication, coupled with simplicity of design with timber-connectors, permitted the completion in less than one year of a 126x450-ft. drydock at Portland, Ore. using 1,250,000 ft. b.m. of Wolmanized Douglas fir.

Located in the harbor of the Willamette River, the structure was started last year on a contract bid of \$185,000 and completed this spring. The drydock was originally built in 1920 of untreated Douglas fir and is made up of five pontoons with two towers on each. The pontoons are 126 ft. wide by 90 ft. long, with each tower measuring 90 ft. long, 38 ft. high, 10 ft. wide at the top and 17 ft. wide at the base. The contract provided for the use of the old and sound pontoons, but replacement of the towers.

All material for the towers was cut to size and fabricated before being loaded on barges for transportation to the site, where it was hoisted into place by a crane after assembly on the ground. Repairs were made to but one pontoon at a time, permitting use of 80 per cent of the drydock capacity. All lumber was fully prefabricated before vacuum-pressure preservative treatment and split-ring and shear-plate connectors were used at all joints.

The specifications called for select merchantable quality for the approximate 700,000 ft. b.m. of timbers making up the frame of the towers, with sizes largely 7x10 in. to 12x14 in. and lengths to 48 ft. A grade of barge planking, shiplapped with calked seam, was specified for the 450,000 ft., b.m., of walls on the exterior of the towers, with sizes of 4x5 in., and 6x8 in. in lengths to 48 ft. A grade of V. G. ship decking, shiplapped and calked seam, was specified for the approximate 50,000 ft. b.m. of covering for the top of the towers, in a size of 3 $\frac{3}{4}$ x8 in. with lengths 30 to 50 ft.

Specifications were prepared by James Healy, supervising engineer, and G. H. Thayer, mechanical engineer, for the Port of Portland. The prefabrication was done by Timber Structures, Inc., of Portland, prior to vacuum-pressure treatment with Wolman salts in the Wauna, Ore. plant of the American Lumber & Treating Co.





B. J. FRY (left) chief engineer of E. J. Albrecht Co., contractor, receives congratulations from E. J. Collins, resident engineer for U. S. Army Engineers, on pouring first concrete for slope paving on his contract.



LAYING CONCRETE PAVING on slope of 1 on $1\frac{1}{2}$ by crew of Al. Johnston Construction Co. Special screed, equipped with winches and cable for hauling up bank, strikes off concrete delivered by chute from truck mixer.

River Channel Paved TO PREVENT FLOOD DAMAGE

CHANNEL IMPROVEMENT of the Conemaugh River and its two tributaries, a U. S. Engineer Department project at Johnstown, Pa., involving pavement of sloping banks with concrete, will enable the stream to carry a flood flow equal to that of March 17, 1936, without topping its banks. Plans provide for improving 3.64 mi. of the Conemaugh River and 5.17 mi. of its two tributaries. The accompanying photographs illustrate typical methods and equipment employed by the several contractors on the project, under the supervision of Lieut.-Col. J. D. Arthur, acting district engineer, A. L. Hertz, project engineer, and Ellsworth P. Daugherty, E. J. Collins and Alfred Goellner, resident engineers. Contractors on four sections of the project include the Al. Johnson Construction Co., of Minneapolis; E. J. Albrecht Co., of Chicago; Freeland, Inc., of Pittsburgh; and Leo Butler Co., of St. Paul.



ELLSWORTH P. DAUGHERTY (left) resident engineer for U. S. Army Engineers, confers with Jack King, general superintendent for Al. Johnson Construction Co.



HAND-OPERATED SCREED riding on side forms strikes off surface of concrete on $1\frac{1}{2}$ on 1 channel slope being paved by E. J. Albrecht Co.

COMPLETED SECTION (below) of concrete slope paving to prevent flood damage on Conemaugh River, built by Freeland, Inc.

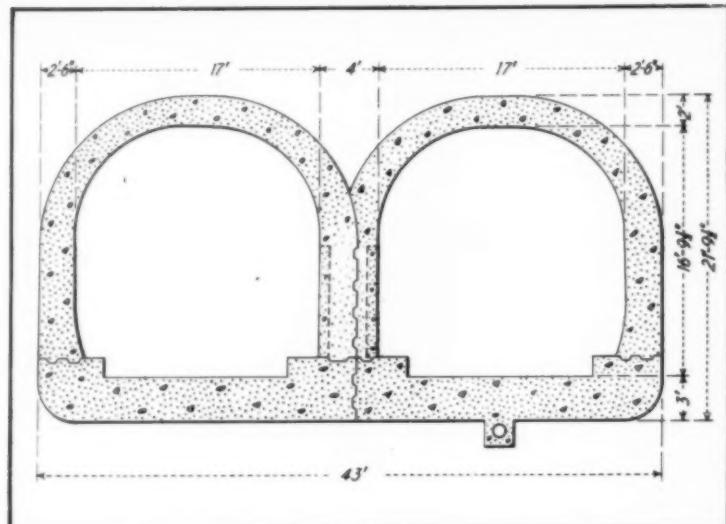


CONCRETE LINING *Pumped* INTO CHICAGO SUBWAY

By R. T. SHERROD
Engineering Department,
Chain Belt Co., Milwaukee, Wis.

EXCEPT IN CHICAGO'S LOOP DISTRICT, where shields were specified, the conventional open-face bench and rib and steel liner plate method has been employed in driving subway tunnels through the city's characteristic blue clay formations. The outlying tunnels are twin tubes, each from 15 to 17 ft. wide and 17 ft. high between stations; at station sections, junctions and cross-overs they are considerably larger. The tubes are driven at an average depth of 45 to 50 ft. below street level from offset shafts located on vacant properties adjacent to the right-of-way. From 12 to 15 lb. of compressed air is carried on all contracts. The ground is of varying consistency, usually soft to medium hard clay, with some loam and sand strata. Air spades and the U-shaped power knives and hand knives, developed in mining Chicago's sticky clay subsoil, are employed in excavating operations. Two, three or more benches are worked at the face, depending on the type of ground encountered and the contractors' individual preferences.

On contracts outside the Loop area, 6-in. H-beam or 7-in.

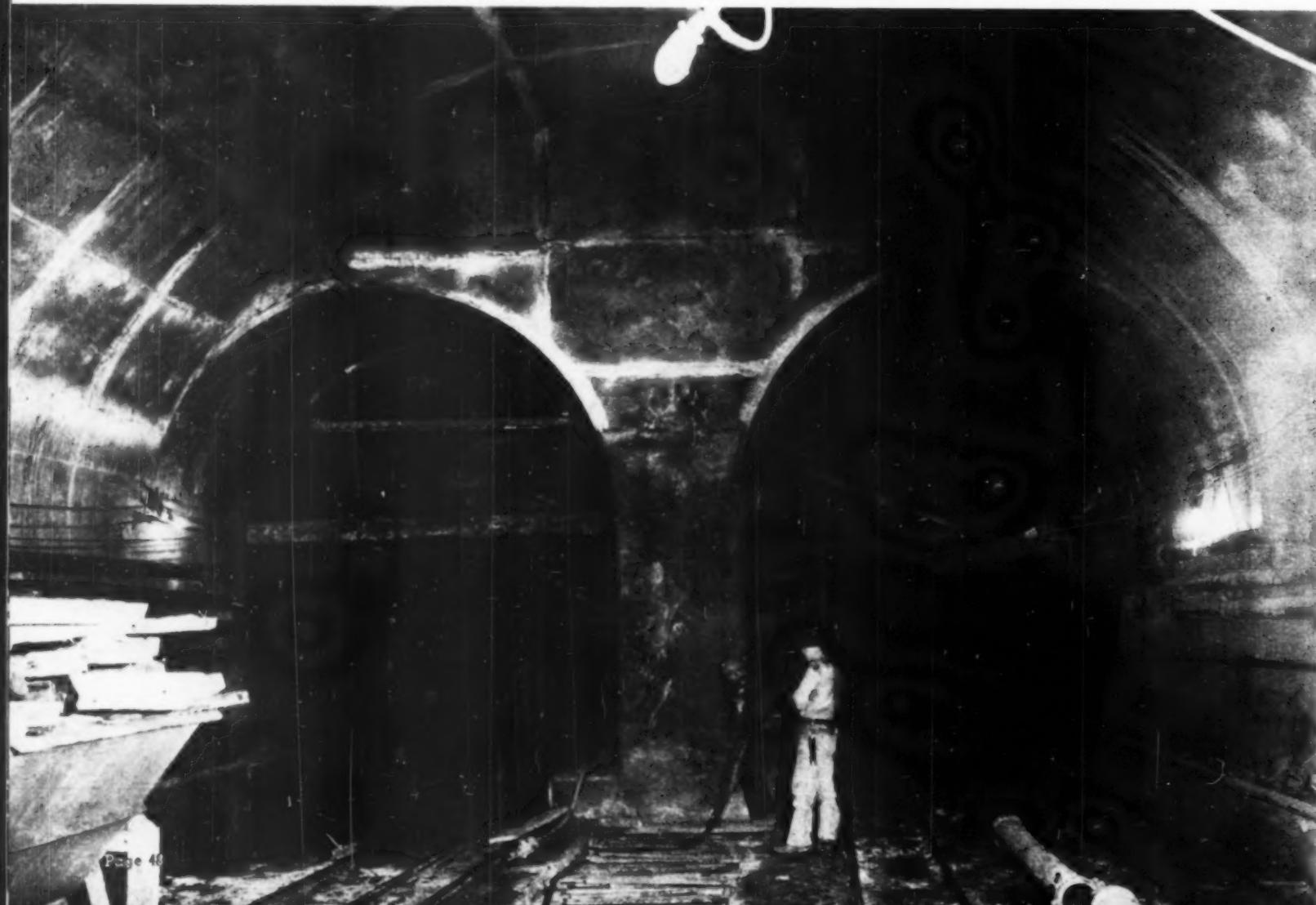


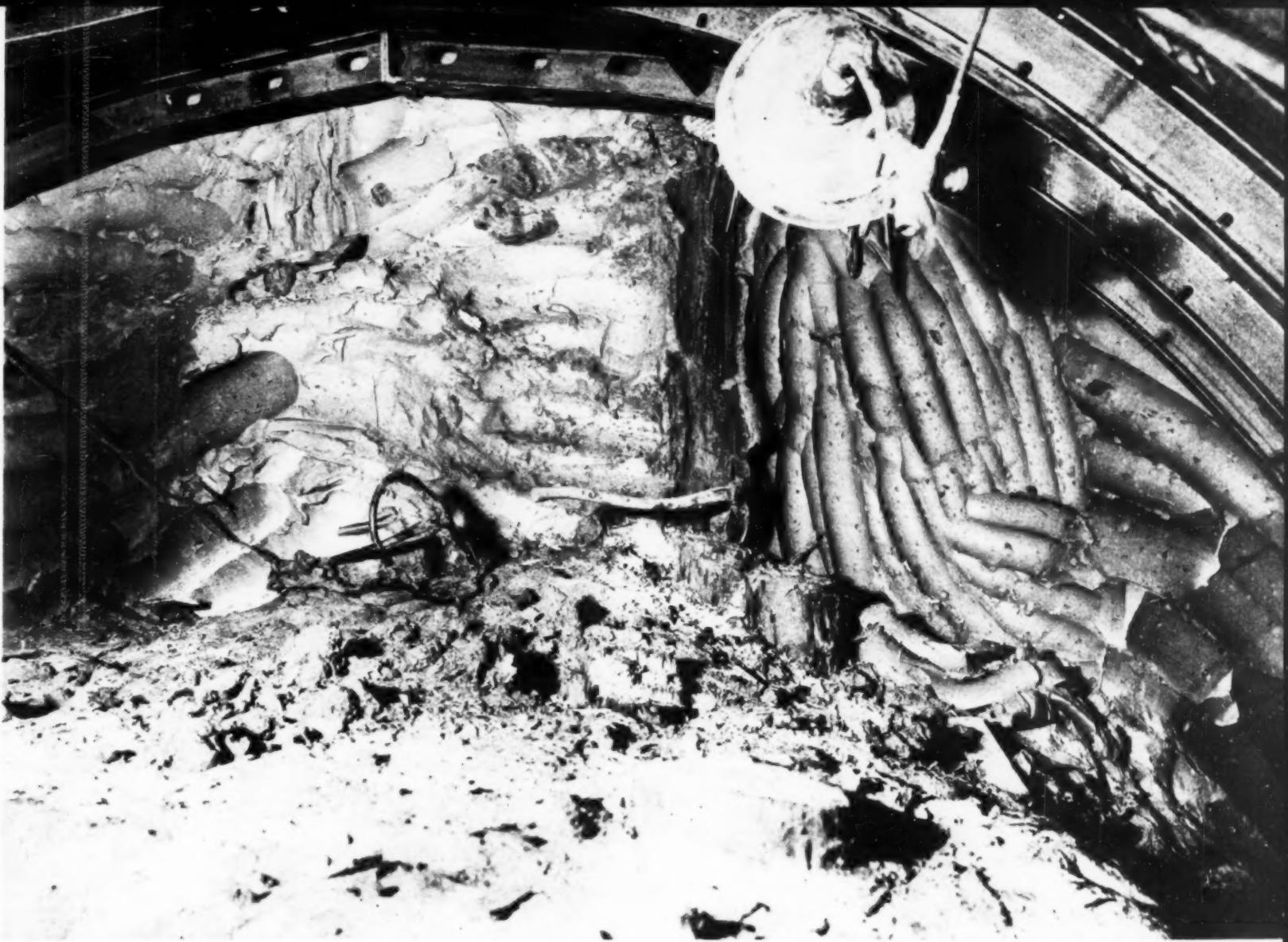
TWIN-TUBE SECTION of Chicago subway of 17-ft. internal width, with common center wall.

I-beam arch ribs, spaced 24 in. on centers and backed with pressed steel liner plates, are used to line the excavation. The ribs are set on horizontal H-beam stringers placed on line and grade just below the spring line and carried slightly in advance of the drive in short monkey drifts. The stringers are supported by straight legs, a continuation of the arch ribs, extending to the bottom of the cut and wedged into place from foot-blocks. Timber drums of 8x8-in. section, secured at either end by stirrup straps, are spaced approximately on 4-ft. centers between the side stringers as spreaders. These cross-drums serve the dual purpose, when decked over, of providing a working platform for operation of air tuggers,

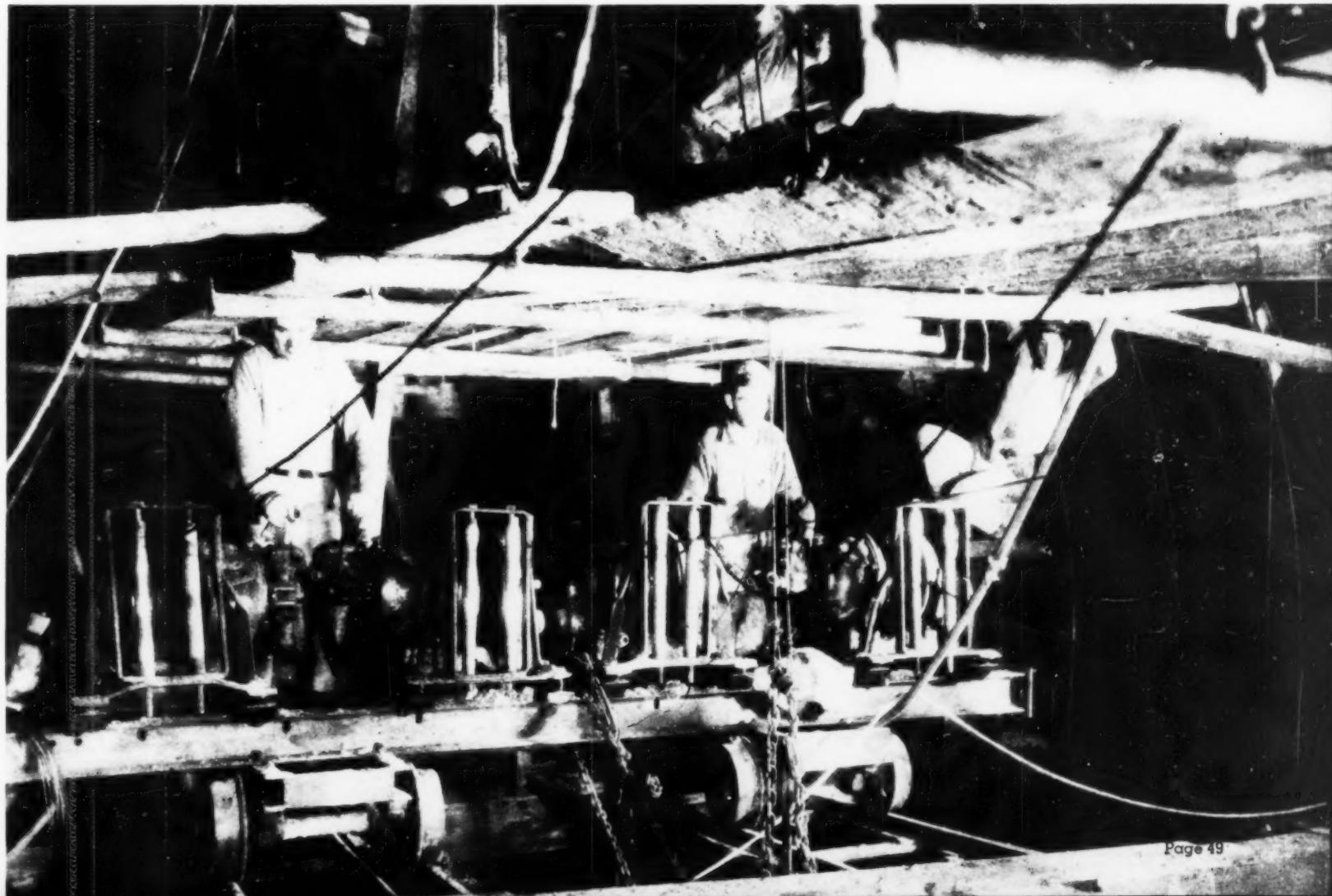
(Continued on page 50)

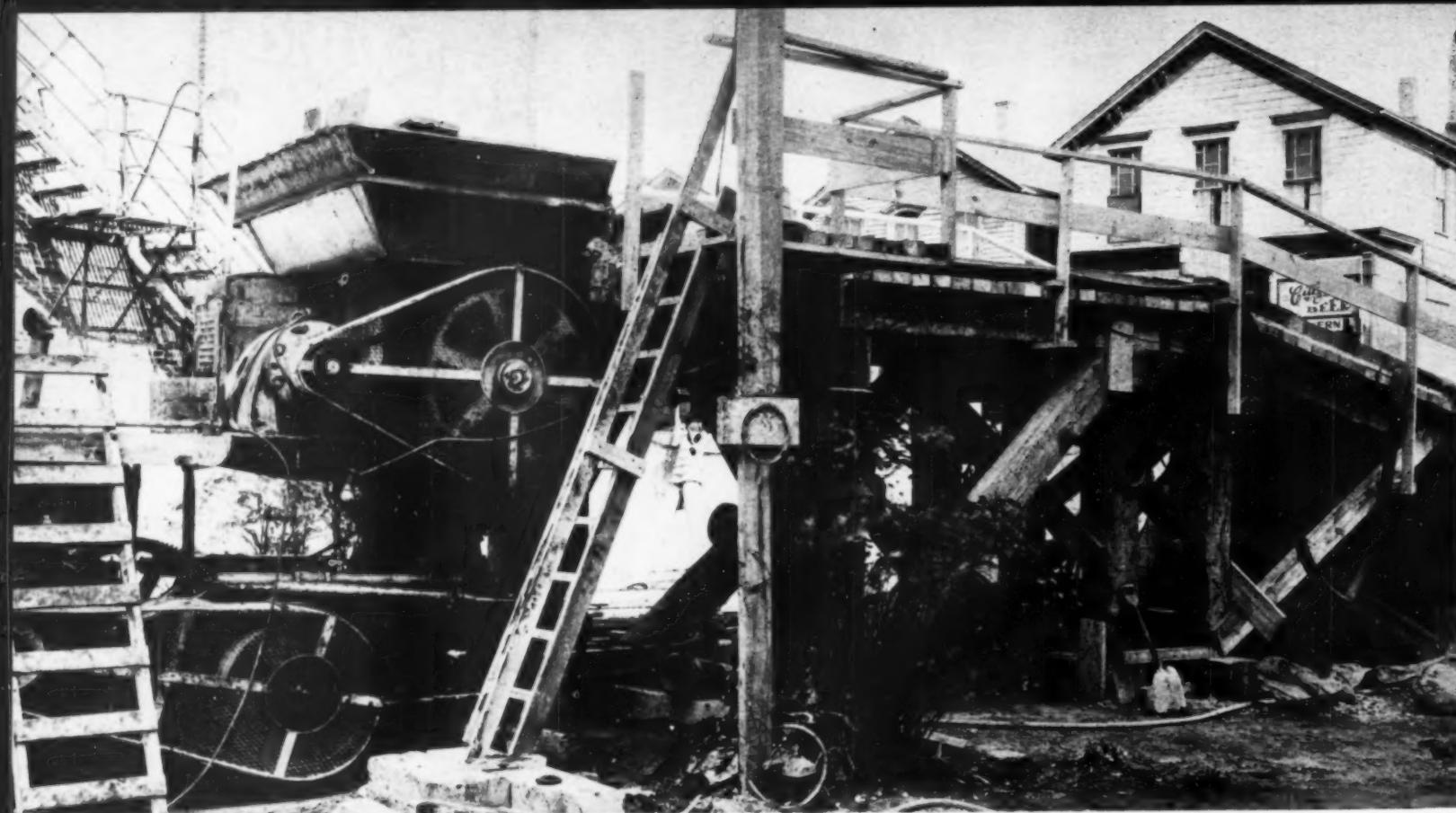
JUNCTION (below) of concrete-lined 15x16 ft. 9½-in. twin tubes with 34x21 ft. 11-in. cross-over section on State St. route.





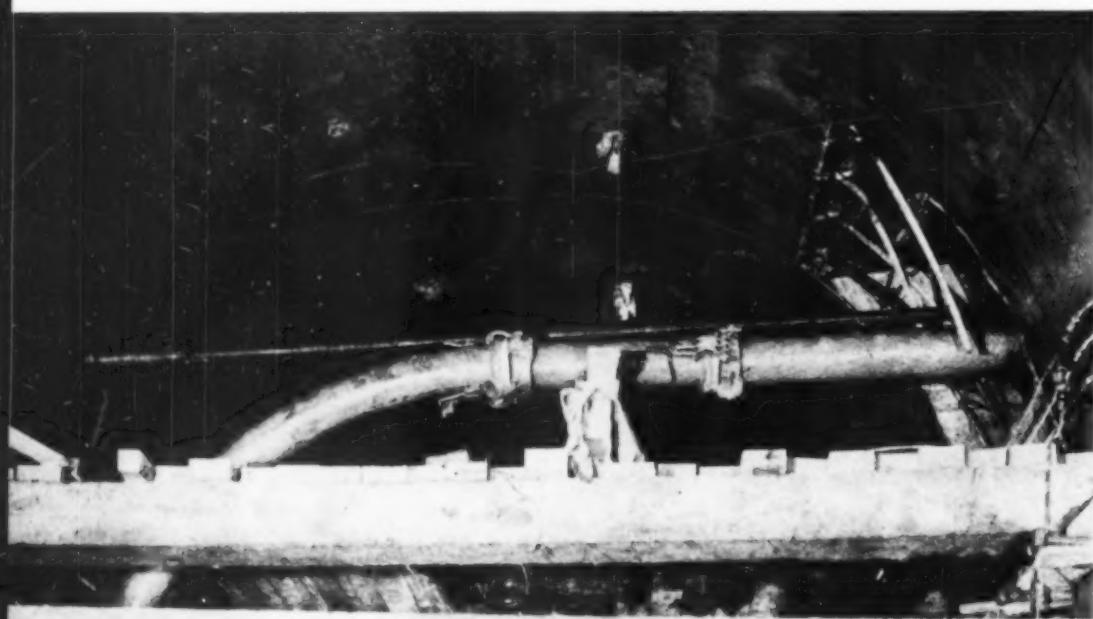
CHARACTERISTIC BLUE CLAY in open tunnel face (**above**) is excavated by slicing off strips with hand- and power-operated knives. Note steel arch rib roof support **FROM BATTERY OF AIR HOISTS** (**below**) cables extend to cutting knives and pull them across face of heading to slice off strips of sticky clay.





CONCRETE PUMPING UNIT is set up in vacant lot on surface and delivers through slanting drop pipe line set in hole extending through ground to tunnel grade. Hopper receives concrete batches from trucks which dump from platform at top of ramp.

EIGHT-INCH PIPE LINE (below) from concrete pump on ground surface delivers through box cut in crown of tunnel. Light-gage pipe is made up in 10-ft. sections equipped with quick-acting toggle connections and air-tight gasket seal. Standard elbows are bent on 5-ft. 2-in. radius.



used in connection with clay-cutting power knives, and for setting arch reinforcing.

Concrete pumps (the Rex Pumpcrete) were used for placing the concrete on seven of the nine tunnel contracts on the project; they placed approximately 80 per cent of the total quantity of concrete involved. Two sections were lined with pneumatic equipment. Concreting operations follow fairly close behind the excavation, with seldom more than 100 lin.ft. of unlined tunnel open on contracts worked by the open-face method. Normally, arch concrete is poured every 48 hr. in each heading. Bottom concrete is poured daily on some contracts and every second day on others.

The size of the pumps and the method of using them varied considerably with different organizations. Some operations used double pumping units, with an hourly capacity up to 65 cu.yd., set up on vacant lots along or near the right-of-way to pump concrete into the tunnel through slanting drop pipes from the surface. The concrete was of a good, plastic consistency and, due to low velocity and a completely filled pipeline, 15 lb. per sq.in. of compressed air in the subway tubes apparently had no effect on the efficiency of the pumping equipment.

Single-cylinder pumps, with an hourly capacity up to 33 cu.yd., were favored by some of the contractors and were operated from a setup inside the tunnel. In this method, concrete from pavers working on the surface is dropped directly into the pump hopper through drill-hole air locks. Drill-hole spacing ran from 400 ft. to 800 ft., depending on

local conditions. This system also was followed on the two contracts using pneumatic placers since they cannot be operated successfully from the outside of a compressed-air tunnel. The shorter placing range of air equipment necessitated a much closer spacing of the drill holes and required the services of a placing unit for each heading. The pumps could be set up in one tube and used to service two headings by means of pipe line cross-overs through splicing chambers or boxed out sections in the sidewall.

M. J. Boyle Contract Methods

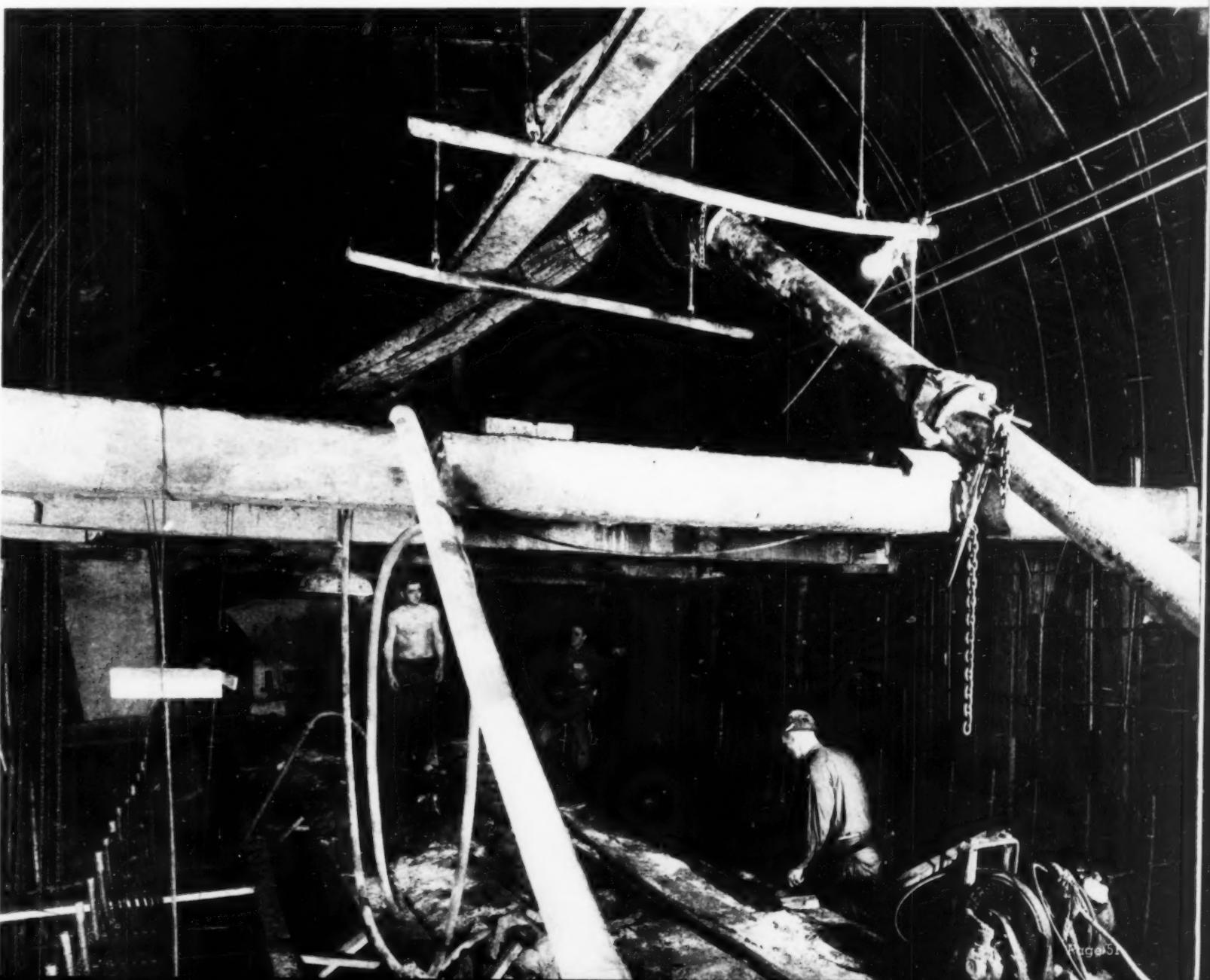
M. J. Boyle, contractor, of Chicago, was the low bidder on adjoining contracts S6 and S7; together they comprise an approximate total of 7,180 lin.ft. of twin-tube section (from 15 to 17 ft. wide by 16 ft. 9 $\frac{1}{2}$ in. in height, inside measurements), 1,015 lin.ft. of station section and a 177.5-ft. cross-over with inside dimensions of 34 by 21 ft. 11 in. The contract starts just North of Halsted St. on Clybourn Ave., runs

(Continued on page 82)

STARTING BOTTOM POUR (below), with bridge in place for continuous mining of tunnel. From centrally located pipe line discharge in arch, concrete is distributed at rate of 60 cu.yd. per hour by inclined coal chutes, shifted as needed. Invert bridge is carried high enough to permit rough screeding of floor surface. In background, muck cars are being loaded from intermediate bench. At this stage only three men handle distribution of concrete, shift chutes and vibrate concrete.



POURING FLAT BOTTOM (above) of splicing chamber between tubes. Entrance for mucking operations and pipe line is through 3x6 $\frac{1}{2}$ -ft. door in right foreground.





"The job's the place to judge a Tractor!"

"I've been out here all morning — and believe me, I've learned something about tractor performance.

"First thing, when the skinners walked out to start the shift they just climbed aboard those HD-14's, kicked the starter and rolled off to the cut. No cranking, no warming up, no greasing — they were getting loads three minutes after the shift started!

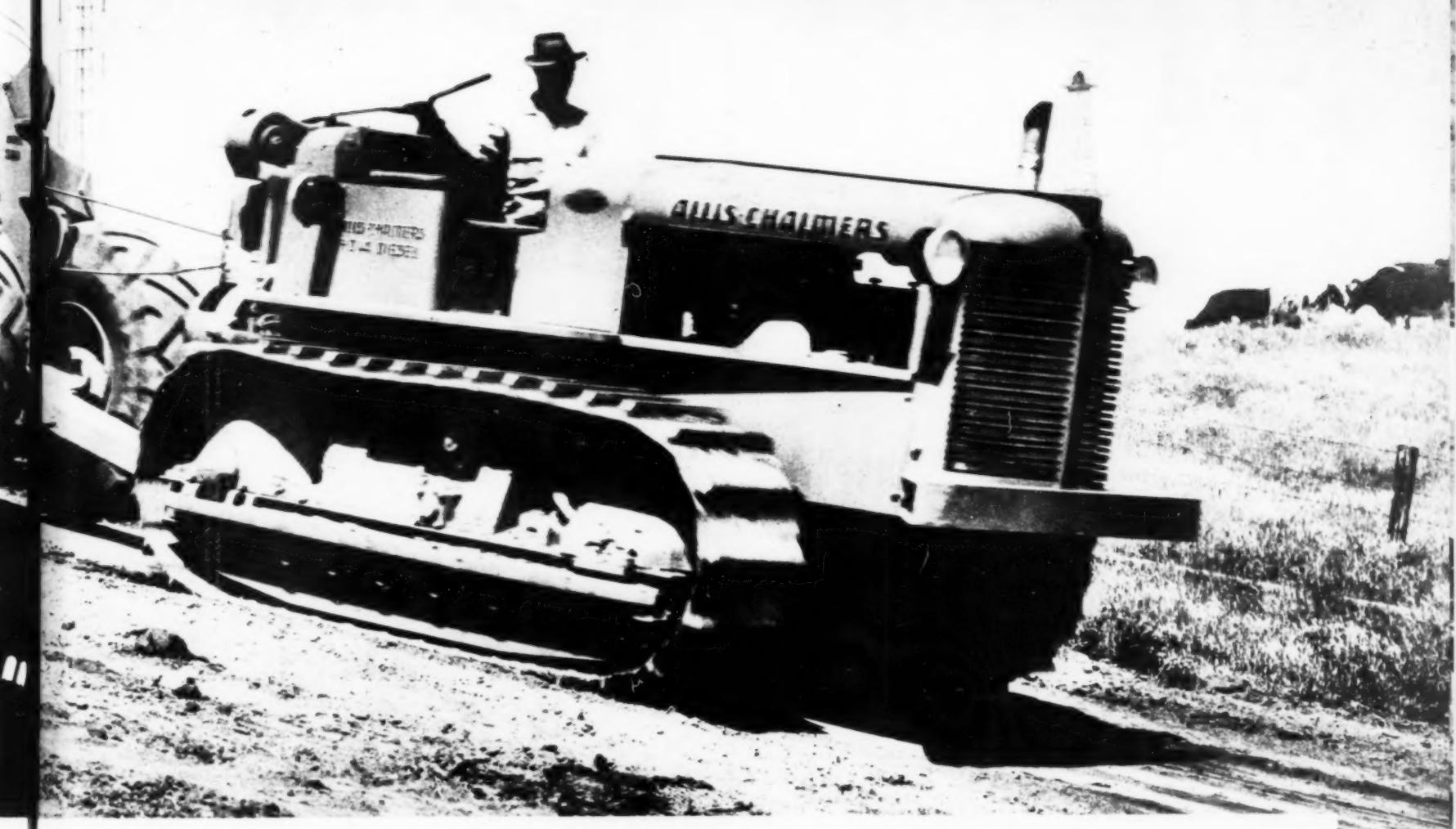
"And power . . . ! that 2-cycle powerhouse they've got in there really has a punch. They work at least one gear higher all the time — haul and backhaul in 6th gear even on upgrades. They can dump at the same speed as they haul, and the Skinner just throttles down for turns — never touches the gears! Those HD-14's are turning in two or more extra trips every hour!

"That tractor gets to work quicker, works faster and gets more done than any rig I ever saw!"

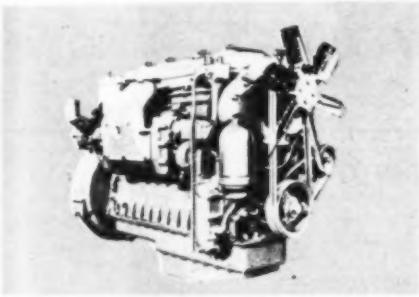
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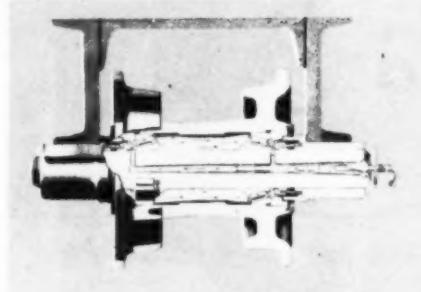
**SMOOTH 2-CYCLE
DIESEL POWER!**



Delivering power every down stroke of the pistons, this compact engine delivers smooth "steam engine" power that hangs on—delivers maximum torque from 1400 right down to 800 r.p.m.! Uses standard Diesel fuels; delivers 95% of its full rated power at 6000 ft. altitude!

**COMPLETELY EQUIPPED
... NO EXTRAS TO BUY!**

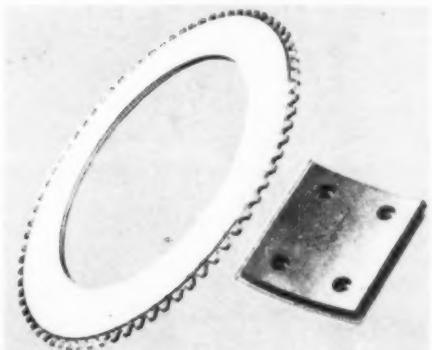
Standard Equipment includes electric starter and lights, muffler, radiator guard, crank-case guard, front pull hook, bumper, hour-meter, radiator shutters, fenders and heavy truck wheel guards. It's a complete tractor, ready to go to work . . . on your job NOW.



**POSITIVE SEAL TRUCK WHEELS
AND IDLERS**

There's a 200-hour supply of lubricant in these truck wheels and idlers...instead of greasing every shift, you lubricate only once every 20 shifts. Saves you about 200 lbs. of grease and 10 hours of working time every 200 hours on the job!

**BIMETALLIC CLUTCH
AND BRAKE LININGS**

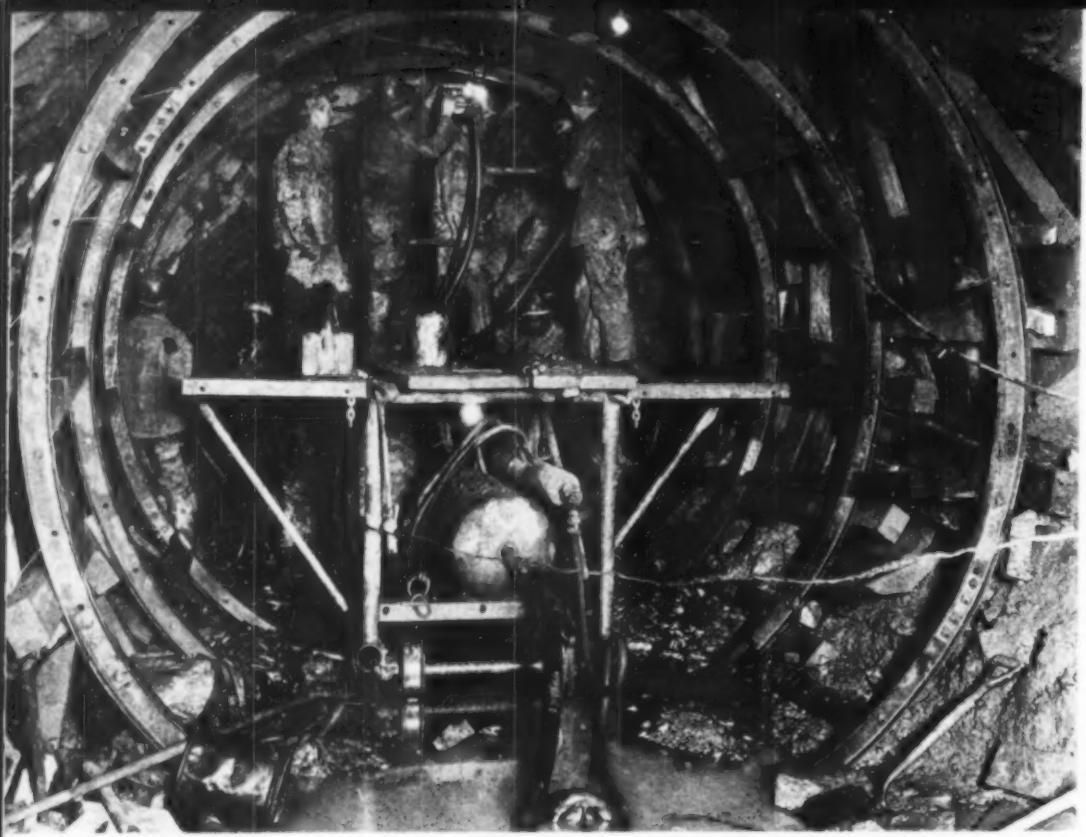


Here's an all-metal friction surface that gives you velvet-touch control plus long life. It conducts heat away from friction surfaces fast, wears slowly and has high mechanical strength.

ALLIS-CHALMERS POWER
TRACTOR DIVISION - MILWAUKEE, U.S.A.

TRACTORS, ENGINES, ROAD MACHINERY

.. IT DOESN'T
COST ..
it Pays!



STEEL RINGS and timber packing prevent rock falls in seamy formation through which Stiers Bros. drive 9-ft. tunnel. Compact drill carriage travels on narrow-gage track.

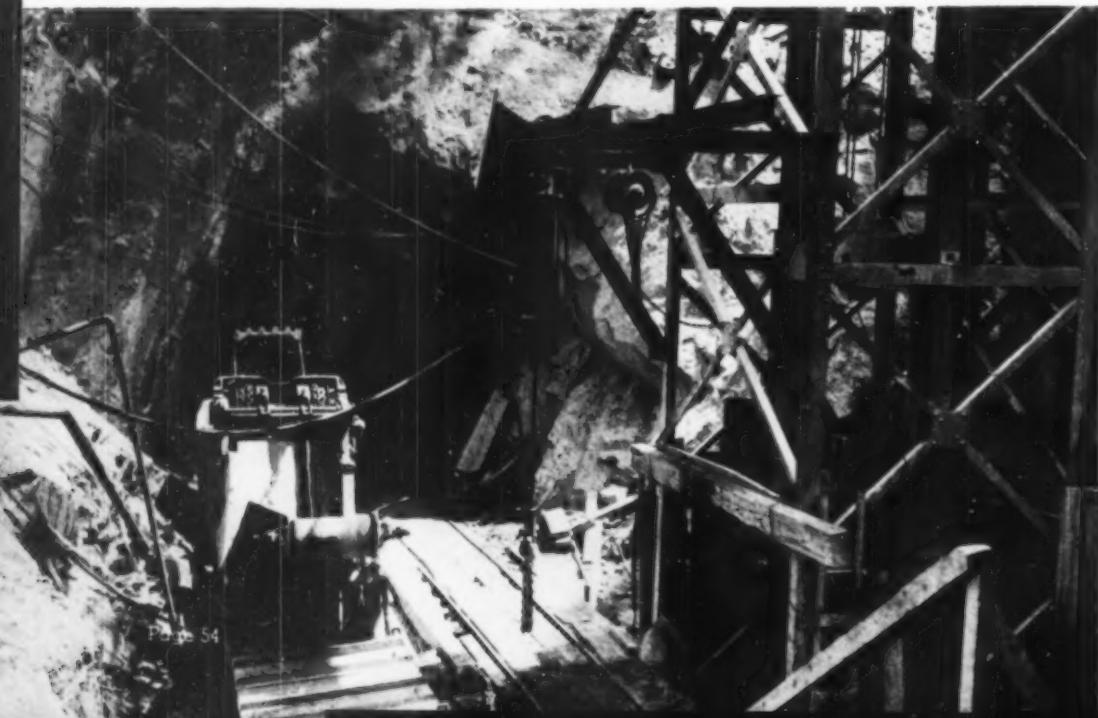
TO CLEAN UP an unsatisfactory condition experienced during storms 30 or 40 times a year in beautiful Rock Creek Park, Washington, D. C., as a result of discharges into the creek from an existing system of interceptor sewers carrying combined sanitary sewage and storm water, the District of Columbia, with the aid of a PWA loan and grant, is constructing 6½ mi. of large-diameter diversion sewers which include 11,000 lin. ft. of rock tunnels. Variable rock formations encountered in the tunnel headings have presented frequent problems of the sort usually associated with this kind of work, but the most spectacular driving methods were required in a 100-ft. section of the longest bore, where it crosses the Washington city tunnel carrying the city's water supply under pressure. Special limitations governed the contractor's procedure in this section, and methods of an unusually cautious and laborious nature were employed to drive the sewer tunnel without damage to the aqueduct.

Exacting Conditions Govern Rock Tunnel Driving For Washington, D. C. Sewers

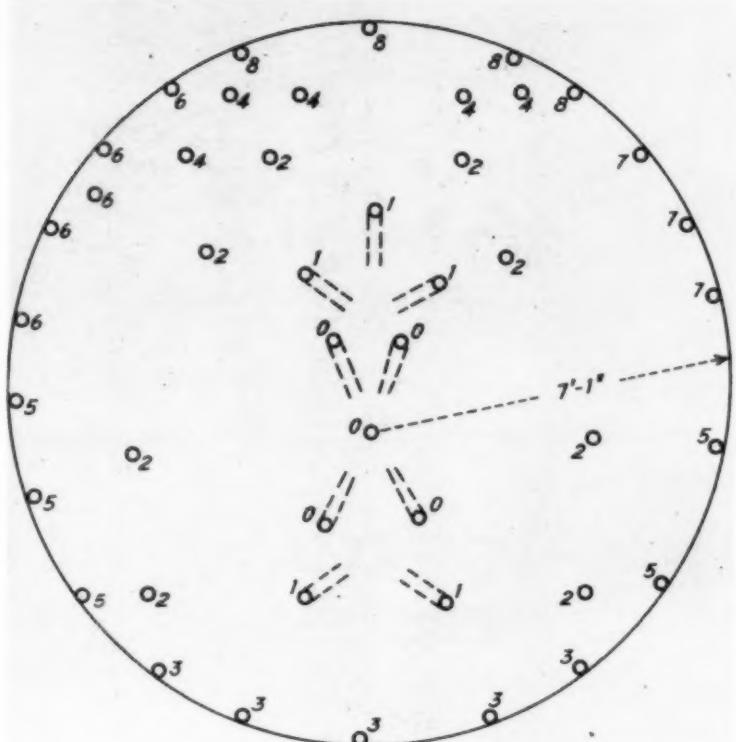


HEADFRAME (at right, below) erected in cut at portal of one Lombardi tunnel hoists muck for loading into trucks at ground level.

DIRECTING CONSTRUCTION of Rock Creek diversion sewers are (starting at right): ELLWOOD JOHNSON, resident engineer; NEIL G. MEDBERY, representative of Metcalf & Eddy, consulting engineers; F. A. HUMM, inspector; and E. M. RICHARDSON, superintendent on south end of Lombardi contract.

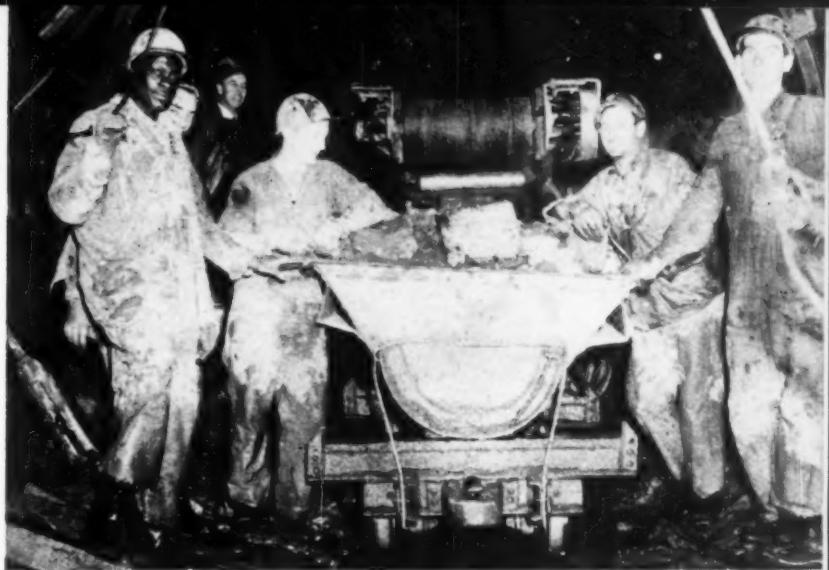


Contractors — Two contractors are building the diversion sewers, one on the east side and the other on the west side of the valley. On the east side, Joseph Lombardi, Philadelphia, is constructing two contract sections of 18,000-ft. total length, including three rock tunnels from 1,560 to 4,160 ft. long. Contract value of the two sections is about \$2,275,000. A shorter sewer on the west side, which is being completed by Stiers Bros. Construction Co., St. Louis, is 8,750 ft. long, and involves two tunnels, 1,120 and 310 ft. in length.

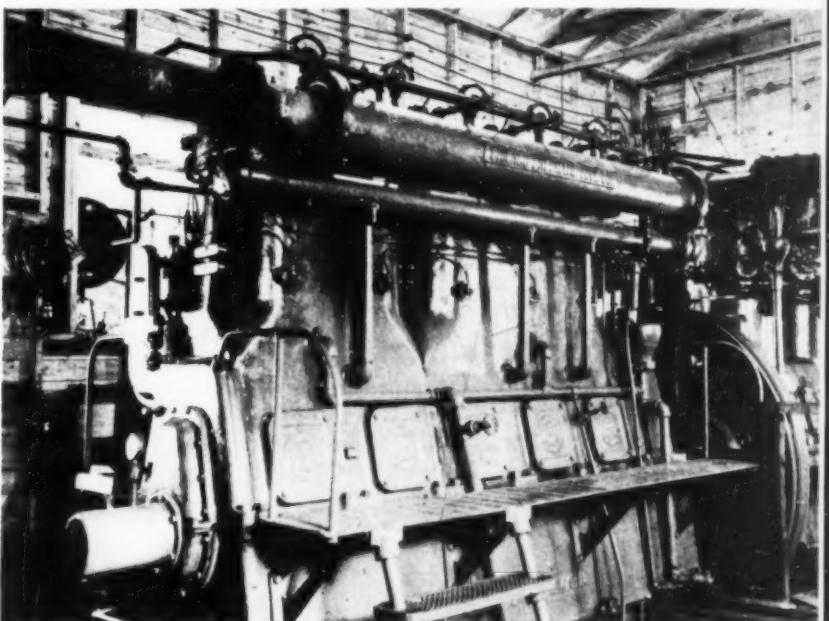


BLAST ROUND REPORT					
Description	Delay	Number of Holes	Depth of Holes	Sticks per Hole	Total Sticks
Baby Cut	0	5	11 ft.	9	45
Main Cut	1	5	11 "	9	45
Reliever	2	5	11 "	10	50
Lifter	3	5	11 "	10	50
Trim Hole	4	5	11 "	10	50
Trim Hole	5	5	11 "	10	50
Trim Hole	6	5	11 "	10	50
Trim Hole	7	4	11 "	10	40
Trim Hole	8	3	11 "	10	30
TOTAL		42			410

TO DRILL AND BLAST this round in rock tunnel for sewer of 12½-ft. finished diameter, Lombardi organization sinks 42 11-ft. holes, loads them with 410 cartridges and fires blast with eight delays, noted by numbering of holes. Dynamite exploded on zero and first delays is 60 per cent gelatin (90 sticks); remainder is 40 per cent gelatin.



CONVEYOR LOADER on mucking machine drops blasted rock into rollover dump car in Stiers Bros. tunnel.



FIVE-CYLINDER DIESEL ENGINE, rated 200 hp., drives 1,100-c.f.m. compressor operated in conjunction with electrically powered 1,350-c.f.m. unit at central station between portals of two 12½-ft. tunnels.

BAD GROUND in Lombardi's 9-ft. tunnel (below) is held by concrete wall and timber sets while drilling crew sinks blast holes to advance heading.



AIR JACK operates bin door on headframe, loading into truck.



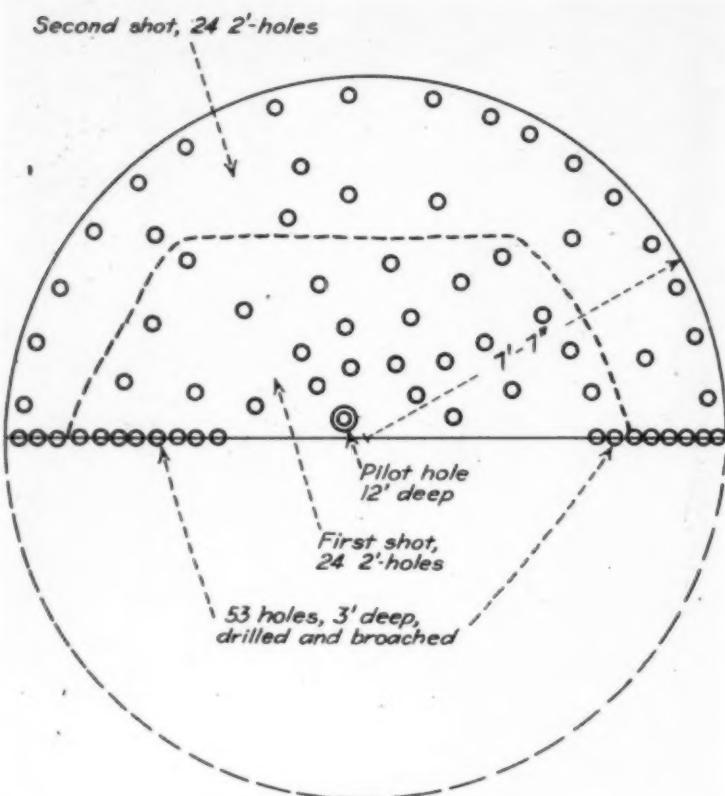


STEEL H-COLUMNS and horizontal sheeting retain sides of deep sewer trench on Lombardi section. H-columns are driven in advance of excavation, and sheeting is placed as trench is dug.

This contract has a value of slightly more than \$800,000.

Additional sewer work in connection with the Rock Creek program includes three contracts with a total bid value of \$560,000. Leo Butler, Silver Spring, Md., completed 1,850 ft. of 8-ft. 6-in. by 8-ft., 2-in. lateral sewer in rock tunnel, connecting with the east side diversion sewer, under a \$210,000 contract. At the upper end of the east side diversion sewer, terminating on Piney Branch of Rock Creek, a Piney Branch relief sewer 4,450 ft. long, to supplement an existing sewer, is being built in open cut by two contractors; Leo Butler on a \$215,000 section, and Frank Carozza, Baltimore, on a \$133,000 section.

Diversion Sewers—With the exception of 1,500 ft. of con-
(Continued on page 82)



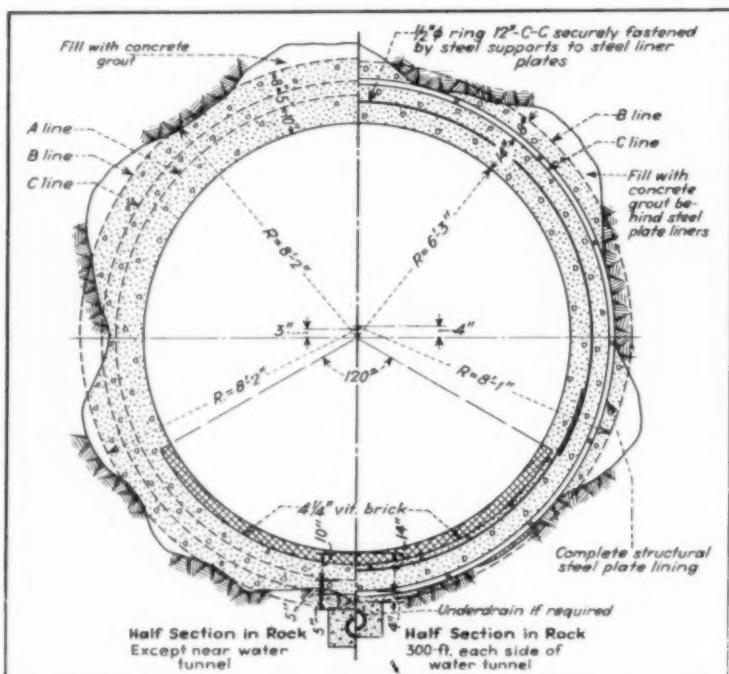
BLASTING RECORD					
Time	Holes	Depth	Sticks	Delays	Exploders
11:57 a.m.	24	2 ft.	42-40%	10	24
12:33 p.m.	24	2 ft.	30-40%	10	24

Maximum amount of explosive in one blast — 4 sticks of 40 per cent gelatin dynamite.

CAREFULLY RESTRICTED USE of explosives in driving top heading of sewer tunnel over pressure aqueduct is indicated by this round, when work is in close proximity to water tunnel. After drilling and broaching bottom of face to 3-ft. depth, crew fires 2-ft. blast holes in two operations, using ten delays for each blast.



ELECTRICALLY POWERED MUCKING MACHINE in one of Lombardi's tunnels forces digging bucket forward into muck pile.



ROCK TUNNEL for 12½-ft. sewer has normal lining of plain concrete, indicated by half section at left. Within 300 ft. each side of pressure aqueduct, which passes about 10 ft. below sewer tunnel, concrete is placed inside continuous steel plate lining and is reinforced by rings of steel bars, as shown by half-section at right. Cavities behind lining are pressure grouted.

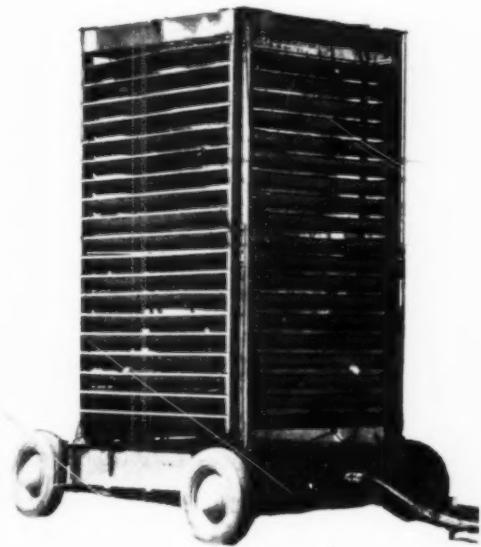
JOKE ODDITIES



BIGGEST TIRE CHAINS are applied to wheels of diesel-powered Tournapull to improve traction for hauling 30-cu.yd. carryall scraper on earth-moving job at Johnstown, Pa. For huge pneumatic tires standing about 7 ft. above ground and costing \$2,500 each, chain-link armor or protective web of welded chain was designed by American Chain & Cable Co. to cover almost entire tread surface.

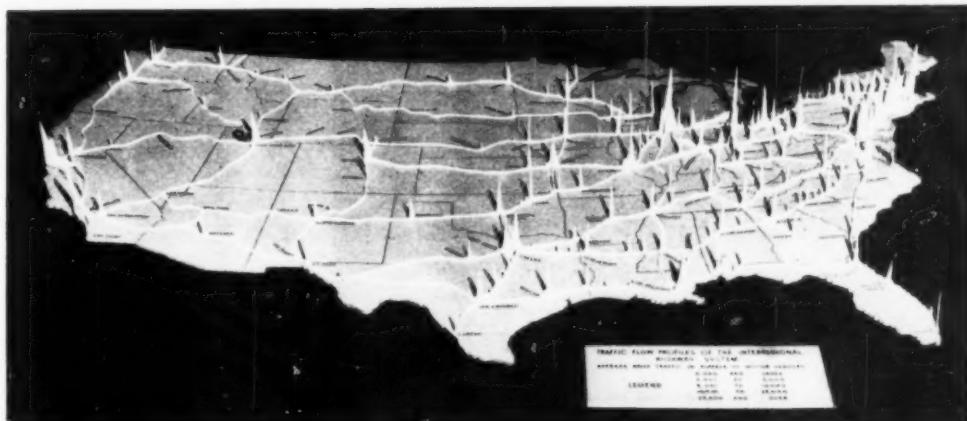
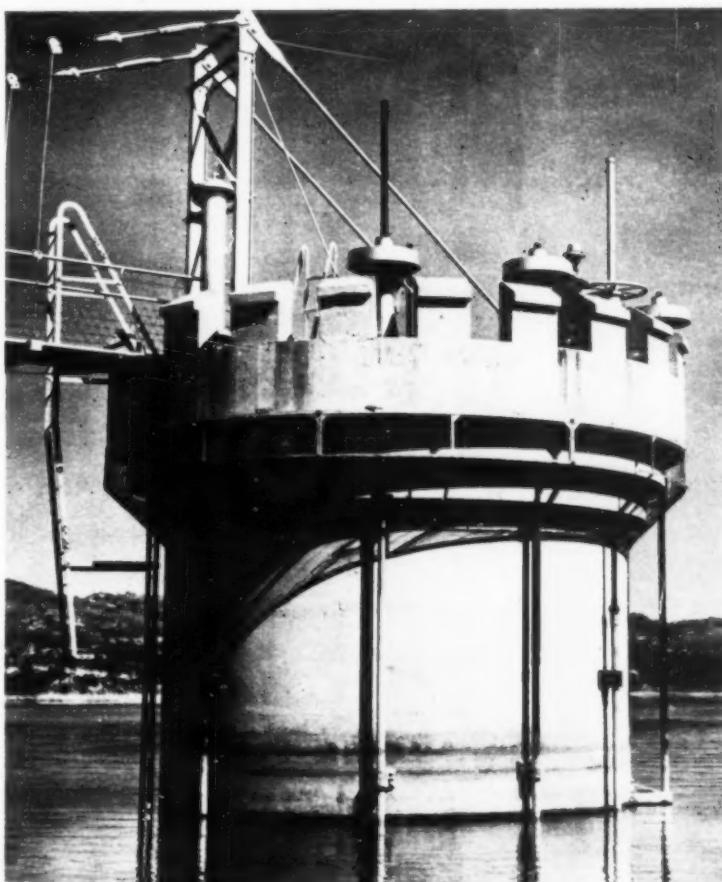


MOUNTAIN-LIKE STOCKPILE contains 3,500 cu.yd. of sand treated with calcium chloride by J. R. Cianchette & Co., of Pittsfield, Me., for application to 300 mi. of ice-covered roads and streets under contract for winter maintenance. Huge central stockpile served as source of supply for smaller piles maintained at strategic points along highways.



THIS PORTABLE COOLING TOWER is used for pre-cooling concrete mixing water on Coachella branch of All-American Canal in Imperial Valley, California, where high temperatures prevail. Temperature of concrete being placed is limited by U. S. Bureau of Reclamation to 90 deg. F. Evaporative tower 10 ft. high, with sides of 1x6-in. slats sloping toward center diffuses water falling from perforated pipes at top to 220-gal. storage tank. Further distribution of water is accomplished by use of 1/4-in. horizontal screens spaced 2 ft. apart, vertically. Pump recirculates water from storage tank through tower as many times as possible before delivery to mixer.

LIKE TURRET ON MEDIEVAL CASTLE (right) outlet tower rises above water surface of San Fernando reservoir, largest municipal water storage basin within city limits of Los Angeles, Calif., operated by Department of Water and Power.

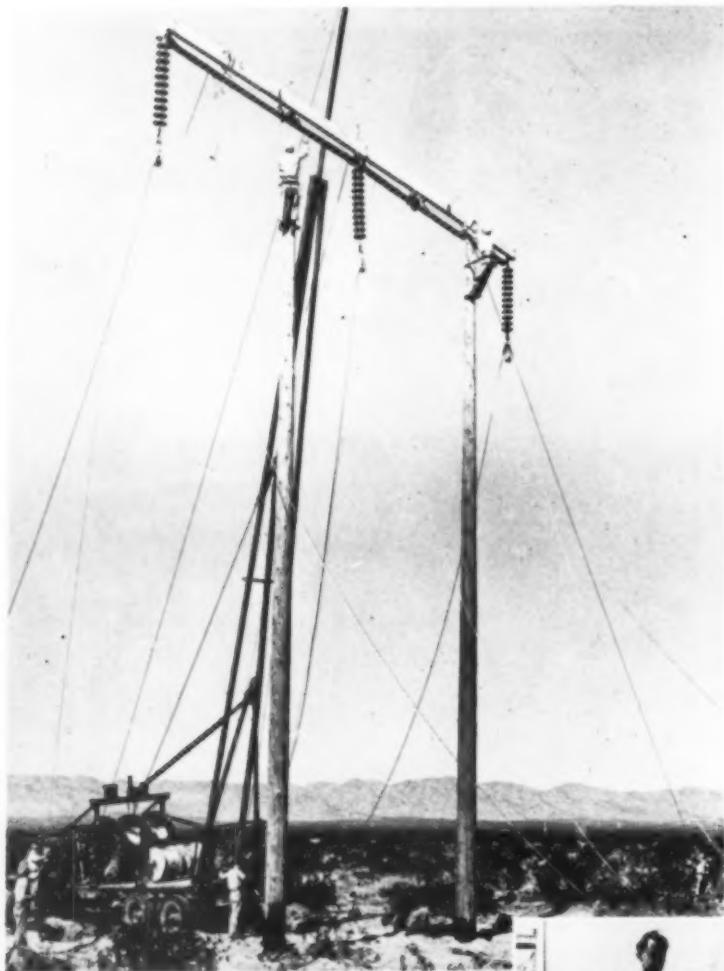


NOVEL TRAFFIC FLOW MAP of inter-regional highway system of United States, has been prepared by Public Roads Administration, Washington, D. C., under direction of H. S. Fairbank, Chief, Division of Information. Heights of traffic bands represent volume of traffic at all points. Peaks show how rapidly traffic builds up as it approaches and passes through cities.

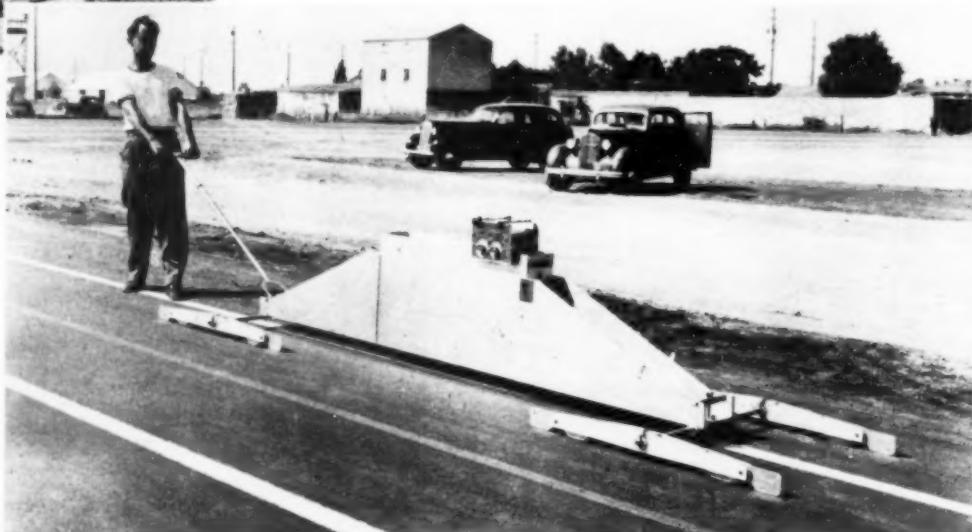
HOW They Did It

CONSTRUCTION DETAILS

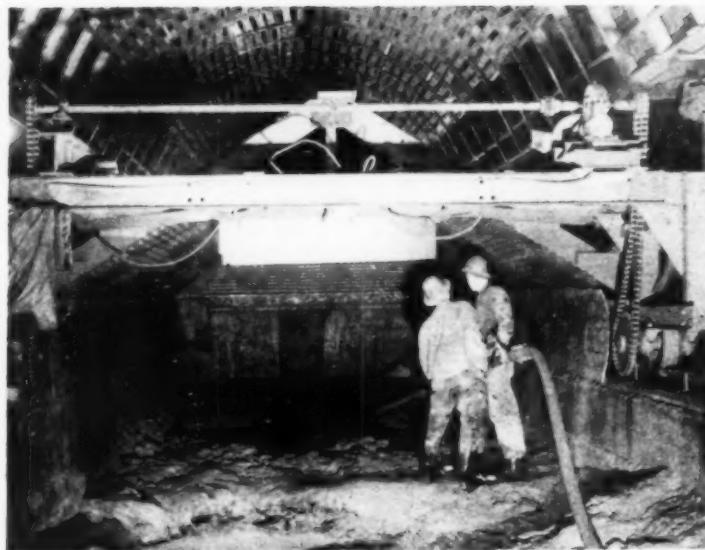
For Superintendents and Foremen



CROSS-ARM RAISING AND WIRE-STRINGING on electric transmission line between U. S. Bureau of Reclamation's Parker dam, on Colorado River, and Phoenix, Ariz., is handled by this rig of Dwight Chapin, Jr., contractor, with tall A-frame mounted on rear end of eight-wheel drive heavy-duty truck carrying wire reels. Outer power phases are laid out on ground from tractor-drawn reel carts and placed in stringing blocks as cross-arm is raised.



ROUGHNESS MEASUREMENTS (right) on state highway pavement surfaces are made and recorded with this lightweight portable machine designed and built at California Division of Highways' materials and research laboratory.



SELF-PROPELLING PROTECTIVE HOOD safeguards tunnel workers from flying fragments of rock as high pressure air jet is applied to clean invert after tractor-bulldozer piled up muck for loading with power shovel. This outfit is used by Associated Contractors, Inc., on Delaware River aqueduct for New York City's water supply.—Photo from J. D. JACOBS, field engineer, Associated Contractors Inc., White Plains, N. Y.



GUARD-RAIL POST HOLES on a Washington State highway are dug with Highway Trailer Co.'s equipment, mounted on a Caterpillar tractor. Holes 20 in. in diameter and 4 ft. deep are put down in 5 min. In these holes go concrete posts 6 ft. long, 9 in. in diameter, spaced on 14-ft. centers and set 3 1/2 ft. below ground surface.



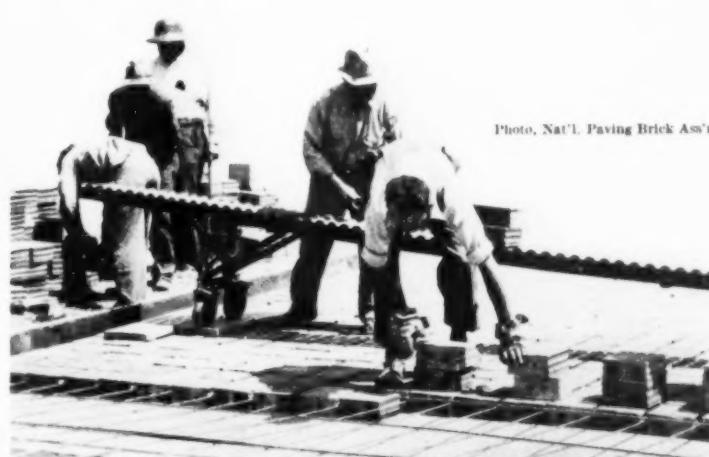
FLEXIBLE LEAD SERVICE PIPE of 2-in. diameter is laid by George H. Kisby & Sons, local contractors, across 340 ft. wide waterway to make connection between Socony-Vacuum office and warehouse and 6-in. cast-iron water main at Atlantic City, N. J. Continuous run of pipe was made up on shore by connecting 25-ft. lengths with wiped joints. Steel hauling cable then was strung along pipe and attached to it at intervals by wire bindings. After rollers were placed under pipe extending back from waterway, end of line was attached to float of two 500-gal. tanks which was pulled across canal by cable from winch on opposite shore. Flexibility of lead pipe enabled it to conform to irregularities of 20-ft. deep channel bottom, and corrosion resistance of metal assures long life in salt water.



PORCELAIN ENAMEL STEEL PANELS designed to assure weathertight joints and to simplify erection and replacement, are used for sidewall facing and for canopy ceilings of toll houses at ten access points along 160-mi. Pennsylvania Turnpike. Panels are 1 in. in depth and have special flanges which act as water seal without reliance on calking compound used in joints. Top flanges of sidewall panels are turned up for fastening with self-lagging screws to steel plates welded to 3-in. channels of building frame. Clips welded in bottom flange of next row of panels rest on this upturned flange. Designed by The Enamel Products Co., Cleveland, Ohio, panels are made by Ingram-Richardson Mfg. Co., Beaver Falls, Pa., with $\frac{3}{4}$ -in. insulation board cemented in place. Carnegie-Illinois Steel Corp. supplies steel for toll houses.



PONDING IN BORROW PIT to insure material of proper moisture content before removal for highway fill near Red Cloud, Neb., is simplified by use of Adams motor grader with bulldozer attachment which forms rectangular pools filled with 6- to 8-in. depth of water from sprinkling wagons. Requirements call for soil with 14 per cent moisture in pit before removal by tractor-scrapers operated by Grosshans & Peterson, contractors.



Photo, Nat'l. Paving Brick Ass'n.



REINFORCED BRICK PAVEMENT is laid on 1-mi. length of South Grand Ave., Springfield, Ill., by Sangamo Construction Co., for purposes of observation and test by Illinois Highway Department. Brick units measure $3\frac{3}{4} \times 8 \times 8$ in. and have lugs on two sides to hold longitudinal steel reinforcing bars in place. Transverse bars are carried by longitudinal bars, forming grid. Each brick has two $\frac{3}{4}$ -in. core holes. Joints $\frac{3}{4}$ in. wide are filled with cement mortar. About half of paved length is supported on sand cushion, while remainder is embedded on 2-in. concrete base.

HANDLING OF BULK CEMENT (left) in 6-ton steel tanks delivered by trucks at batching plant of Roy L. Houck, contractor, of Salem, Ore., is done with Le Tourneau, 30-ft., 10-ton tractor-crane powered by Caterpillar D-8 tractor. Special line to power-control unit tips tanks for dumping. Outfit handles 30 tanks per day.

Road-Mix Machine

PROCESSES STABILIZED SURFACE FOR COUNTY HIGHWAYS

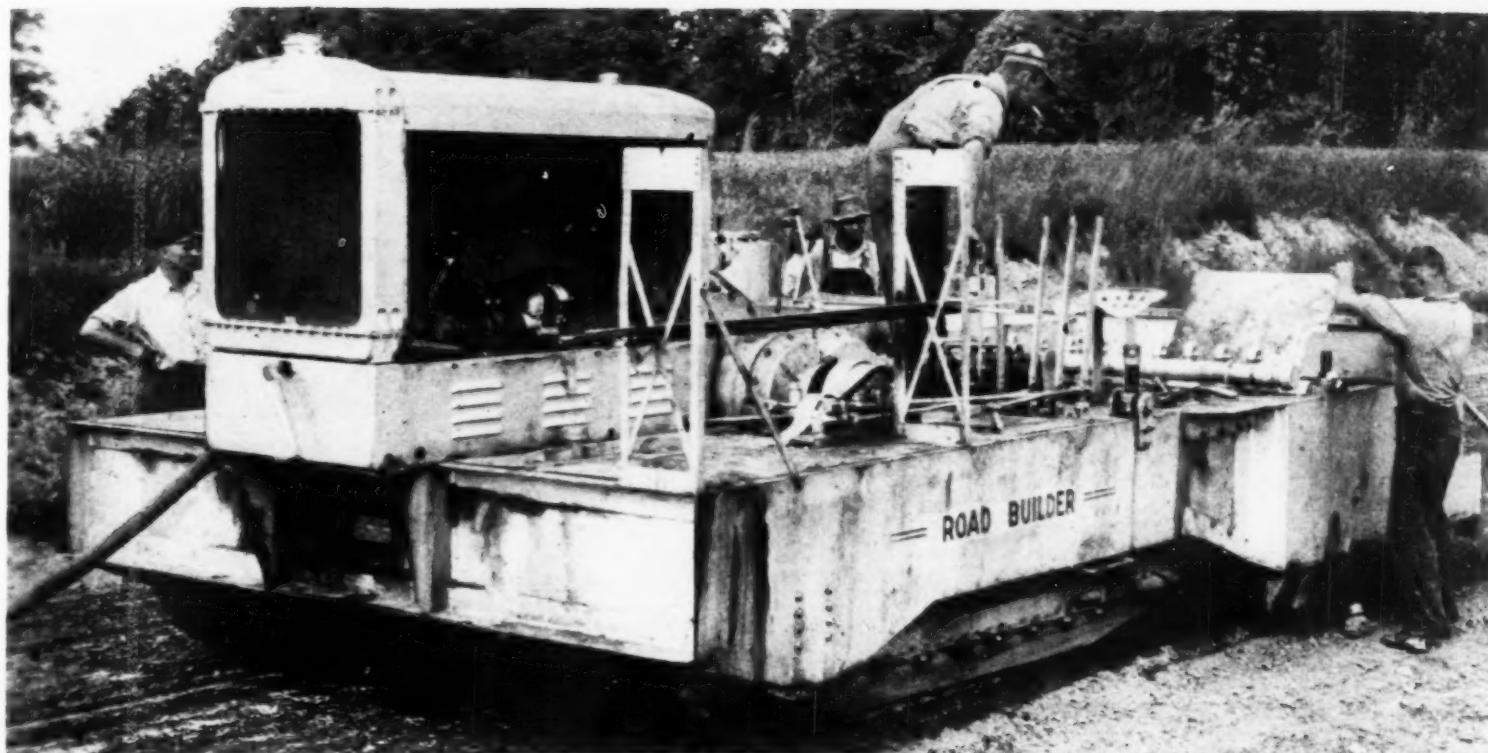
By W. VIRGIL STINE
Engineer-Inspector,
U.S. Public Roads Administration,
Ashland, Ohio



AFTER CRUSHER-RUN BANK GRAVEL has been distributed on roadway by spreader boxes, grader equipped with compensating runner bar strikes off material to proper crown and width.



SELF-PROPELLED ROAD MACHINE equipped with reserve tank filled by water truck mixes binder clay, crusher-run bank gravel, calcium chloride and water to produce final stabilized mixture moistened to optimum moisture content.



MOVING FORWARD at rate of 600 to 800 ft. per hour, road machine mixes full width of stabilized surface in two passes, adding proper quantity of water and tamping completed mixture. Calcium chloride admixture has been applied to surface of material in front of machine at rate of $1\frac{1}{2}$ lb. per square yard.

MAKING USE OF NATURAL GRAVEL and clay deposits with which Wayne County, Ohio, is liberally endowed, the Ohio Engineering Co., Lorain, Ohio, last year surfaced nine county roads totaling 21 mi. in length with $2\frac{3}{4}$ to 3 in. of stabilized clay-gravel 18 ft. wide, mixing the materials in place with a self-propelled road machine which masticated, moistened and tamped the mixture. Calcium chloride was incorporated in the mix to maintain the moisture content of the stabilized surface, which will serve as the wearing course until traffic warrants addition of a bituminous mat. Total cost of the road improvements, including machine-cleaned ditches and semi-stabilized berms, averaged \$2,350 per mile.

Materials—After the mixture design
(Continued on page 94)

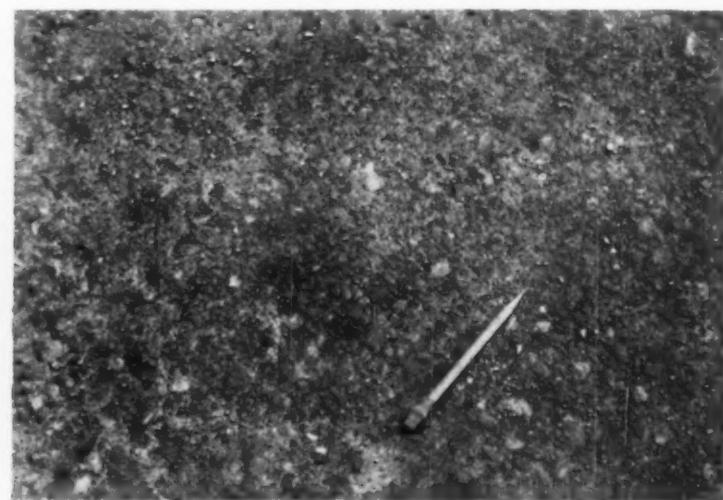
ROAD BUILDER



TEN TAMPERS driven by eccentric shaft at rear of road machine are equipped with teeth which compact stabilized mixture by repeated, closely spaced blows.



MIXING TEETH mounted in spiral rows on rotating shaft of mixing chamber masticate and blend materials to produce stabilized mixture.



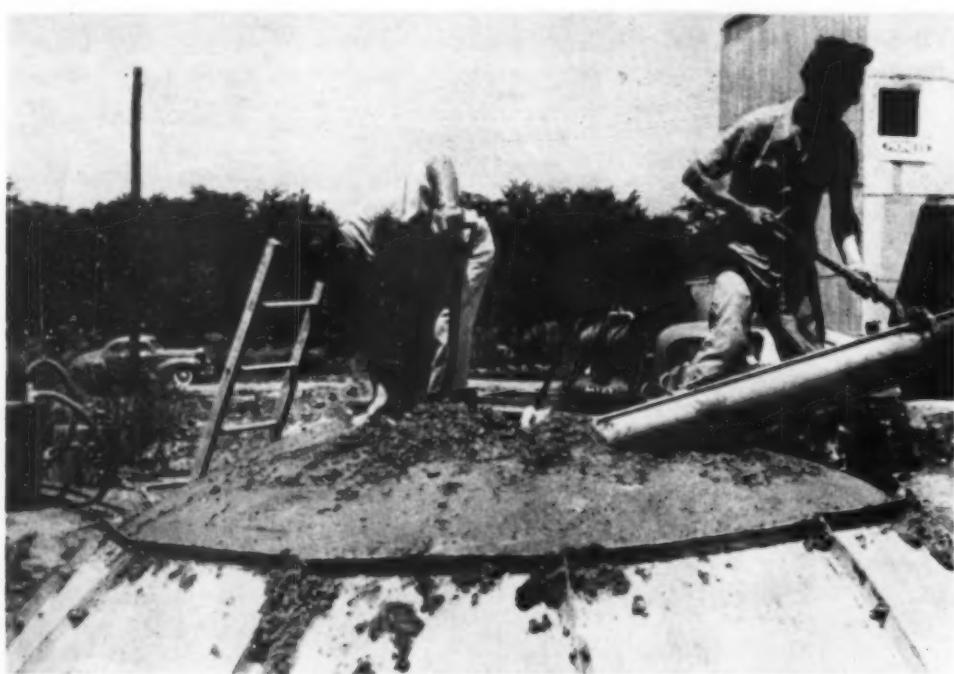
COMPLETED SURFACE, after final application of $\frac{1}{2}$ lb. per square yard of calcium chloride, reveals well-graded, dense and firmly bound material.



OUTSIDE FORM made up of twelve sheet metal sections bolted together surrounds inflated rubber inside form. All forms are equipped as vacuum mats connected through hose lines to compressor operated as vacuum pump.



RUBBER VACUUM MAT is placed over top of dome-shaped pillbox to remove excess water from this portion of concrete.

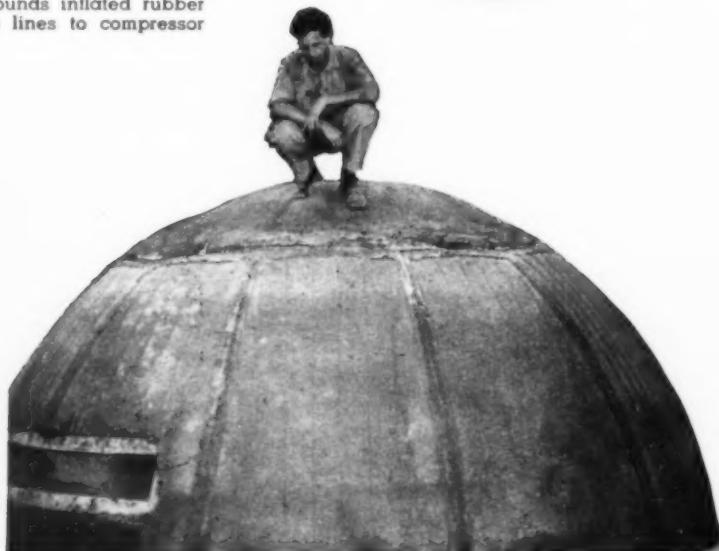


CONCRETE is deposited on inflated rubber inside form to complete top of dome. In background is truck-mounted compressor used as vacuum pump.

Anti-Tank

Pillbox

BUILT IN 5 HOURS

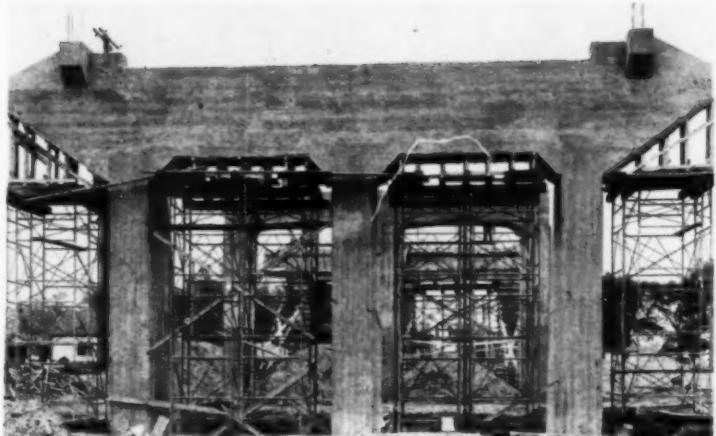


AT END OF 5 HR., completed pillbox is ready for service, with all forms stripped. Weak gypsum cement mix is removed from gun slits.

APPLYING THE VACUUM PROCESS to dome-shaped concrete pillbox construction through the medium of special forms, Vacuum Concrete, Inc., Philadelphia, recently completed one of these small forts 15 ft. in outside diameter, with walls more than 2 ft. thick, in 5 hr. at a demonstration in Washington, D. C. In this time, an inexperienced crew erected the forms, placed 25 cu.yd. of concrete and, after the concrete had been hardened by vacuum processing, stripped the structure ready for service. Ordinary portland cement concrete, 6 1/4-bag mix, 3-in. slump, was used, and no reinforcing steel was incorporated in the pillbox. The cost was less than \$500.

Designed by Karl P. Billner, president of Vacuum Concrete, Inc., to attain the strength advantages of the dome shape with rapid construction, the pillbox was built with a thin rubber inside form inflated to a pressure of 4 lb. per square inch, a metal outside form in twelve sections, and a rubber mat to process the top of the dome. All these units were equipped to apply a vacuum to the concrete. A truck-

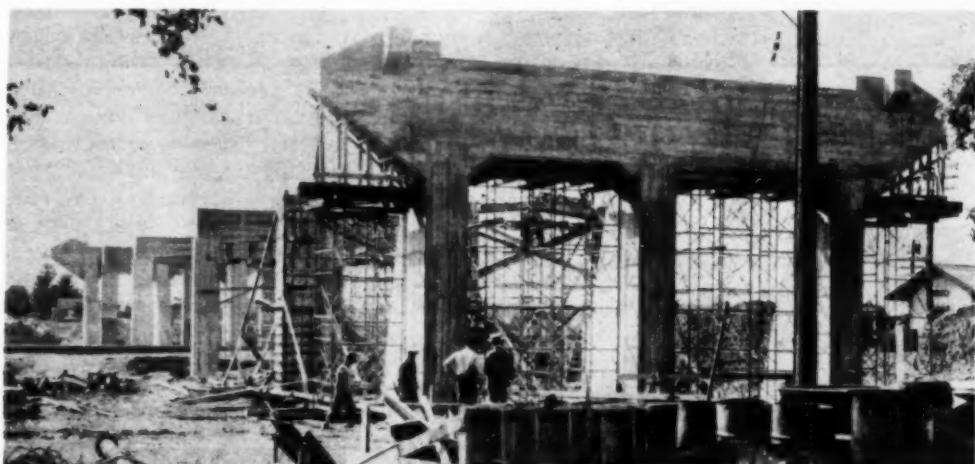
(Continued on page 75)



LIGHT-WEIGHT SECTIONAL SCAFFOLD FALSEWORK supports heavy loads of beam spans and cantilever wings on abutment bent of grade separation bridge.

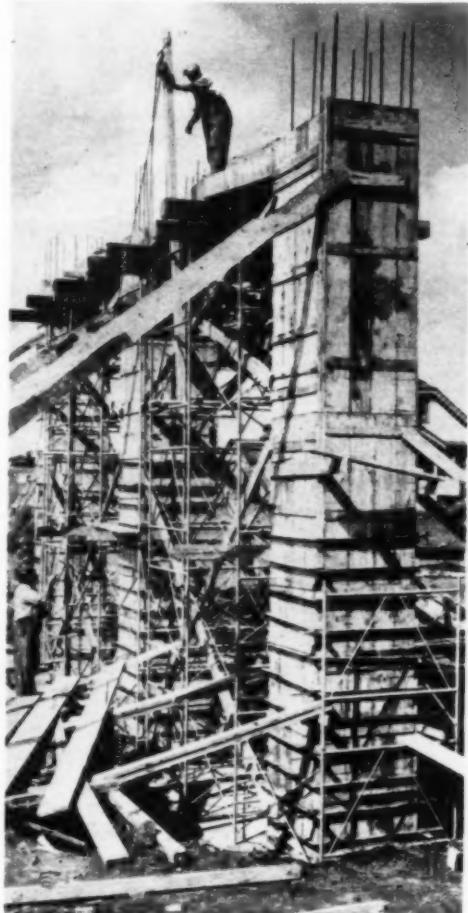


BEAM FORMS (right) of intermediate bent rest on sectional steel scaffold towers; additional steel scaffold frames support concrete pipe line on form wales.



GIN POLE (below), fastened to scaffold tower, hoists materials for building beam form of intermediate bent.

SIX BENTS of grade separation bridge are constructed with aid of sectional tubular scaffolding, which here is seen in place under cap beams of last three piers to be completed.



SECTIONAL STEEL SCAFFOLDING is utilized for falsework purposes under direction of **HOWARD CAIN**, superintendent, Bentley Construction Co., Milwaukee.

Sectional Steel Scaffold SERVES AS FALSEWORK FOR BRIDGE PIER BENTS

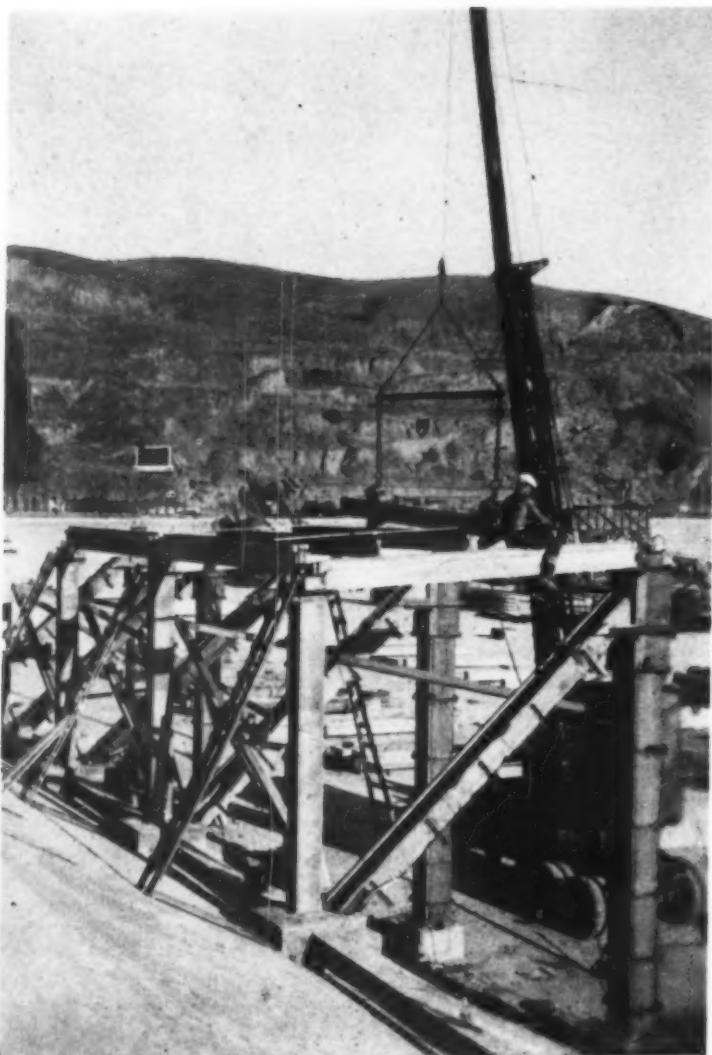


AN INNOVATION IN ADAPTING SECTIONAL STEEL SCAFFOLDS to falsework uses netted a clear gain for the Bentley Construction Co., Milwaukee, in increased ease and speed of building six concrete bents of a grade separation bridge designed by the Wisconsin Highway Department to carry East College Ave. (county road ZZ) across the Chicago, Milwaukee, St. Paul & Pacific main line 5 mi. south of Milwaukee. To support concrete cap beams of the bents, the contractor erected steel scaffold towers in compact groups and placed the beam blocking and forms on the scaffolding. Concentrated grouping of the towers under the beams required interlacing of the cross braces, but the interlaced braces were not connected, and the towers functioned as independent units. Accompanying photographs show how towers were combined under the beams to support forms and concrete.

Six reinforced-concrete three-column bents, designed as monolithic units above the footings, were involved in the contract. The abutment bents were the heaviest structures, the beam load between columns on these units amounting to more than 70,000 lb. Under each of these beam spans the contractor erected a scaffold combination made up of one six-post tower and two four-post towers. Cantilever wings on the abutment bents imposed loads of about 30,000 lb. each, supported by a combination of two four-post towers. An arrangement of one six-post and one four-post tower took care of the beam load between columns of the intermediate piers.

Falsework towers were made up of standard Safway weld-

(Continued on page 99)



1 PRECAST CONCRETE BEAMS were lifted to place with spreader. Timber extension was necessary on boom of crane mounted on truck.

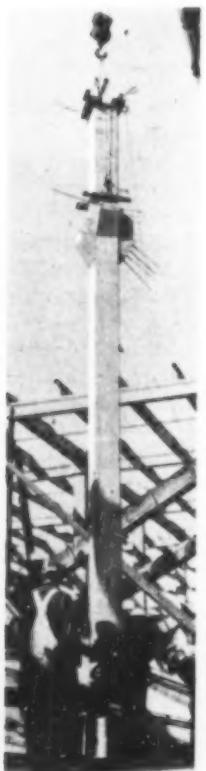
Step-by-Step Field Methods

PRECAST CONCRETE FRAMEWORK SUPPORTS 4-ACRE ROOF

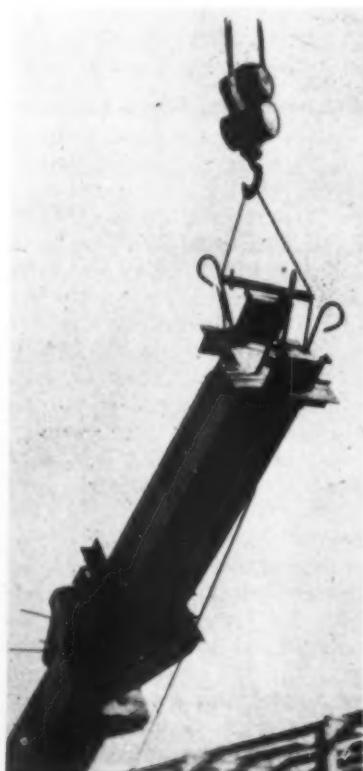
A RESERVOIR ROOFING JOB recently completed at Ventura, Calif., has put 4 acres of corrugated-iron cover over a previously open storage of part of the city's water supply. The roof is carried on a framework of precast concrete columns and girders, a type of construction that was decided upon just after the destruction by fire of a large timber roof over a reservoir at Berkeley. Ventura wanted something that could not burn!

The 515 columns which are the principal supports for the roof are spaced to form rectangular bays in which girder and beam spans are, in general, 19 and 17 ft. respectively. The columns, ranging up to 24 ft. in length, as well as the other precast members, were erected with a truck crane. Steel reinforcing was left projecting into joints between precast members and was welded prior to pouring the concrete that incases terminal projections from sometimes as many as five members in the same plane. Transverse girders were cast in place at intervals to give desirable continuity and rigidity to the structure. The sequence of construction operations is shown in the accompanying pictures.

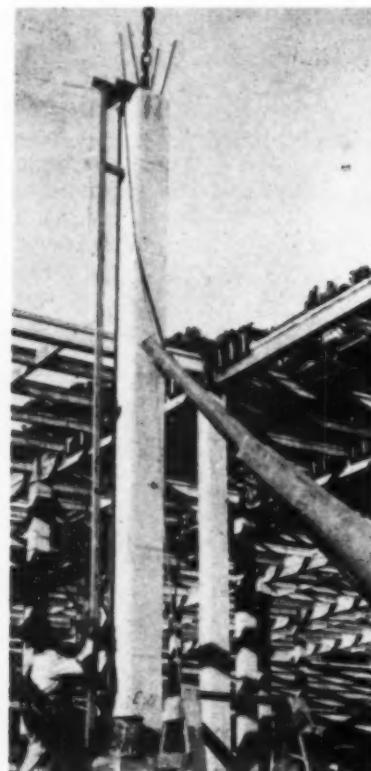
Design of the supporting framework for the roof was made under the supervision of Carl Froerer, city engineer; Richard Valentine was structural engineer and Walter S. Swan, resident engineer-inspector. Major Wm. W. Post represented the PWA; H. B. Nicholson held the general contract. Some of the precast members were made by Graham Bros., Los Angeles.



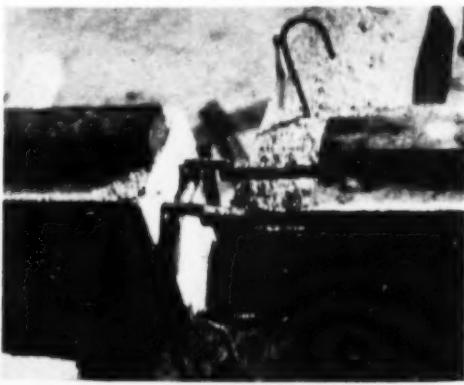
2 CENTRAL COLUMNS are 24 ft. high. Note reinforcing steel projecting for diagonal bracing.



3 COLUMNS WENT UP with angles bolted in place to serve as convenient landing points for beams and girders.



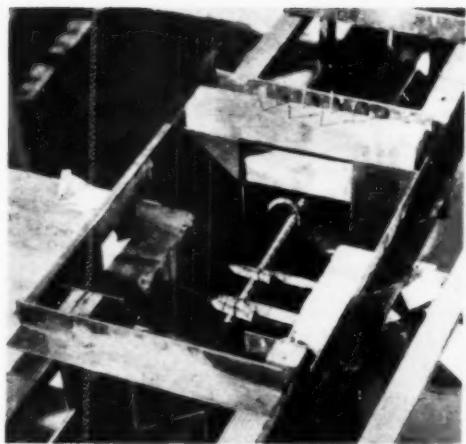
4 WHILE EACH COLUMN was held in place by crane, it was plumbed by plumb bob pivoting around top of column, and was then held by two braces until girders and beams were put in.



5 TYPICAL STEEL PROJECTIONS for joints and cast-in-place transverse girder.



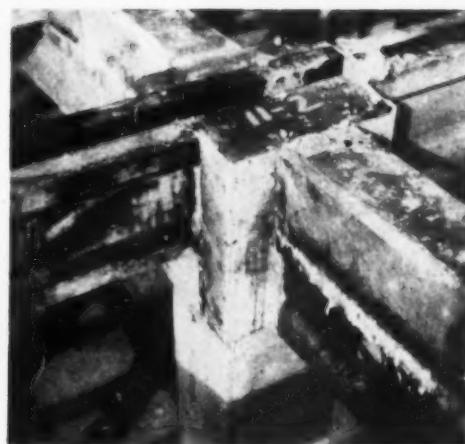
6 PLACING JOINT FORMS for transverse girder.



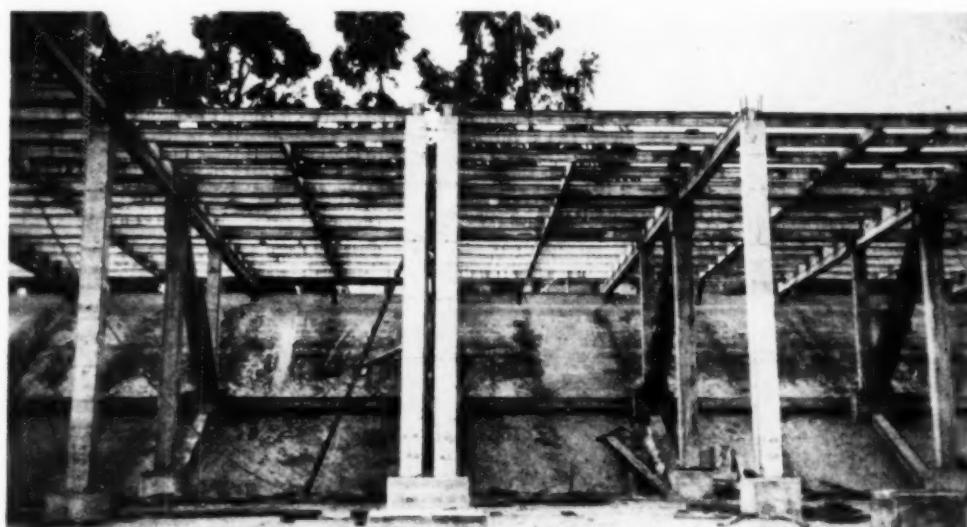
7 IN THE JOINT over each column, steel bars were overlapped and welded to secure rigidity.



8 CAST-IN-PLACE CONCRETE in transverse girder is here being vibrated.



9 COMPLETED JOINT over column. Five pre-cast members and one cast-in-place beam are united in this joint.



10 EXPANSION JOINTS, necessitating double row of columns and girders, traverse reservoir in both directions, dividing roof structure into four units.



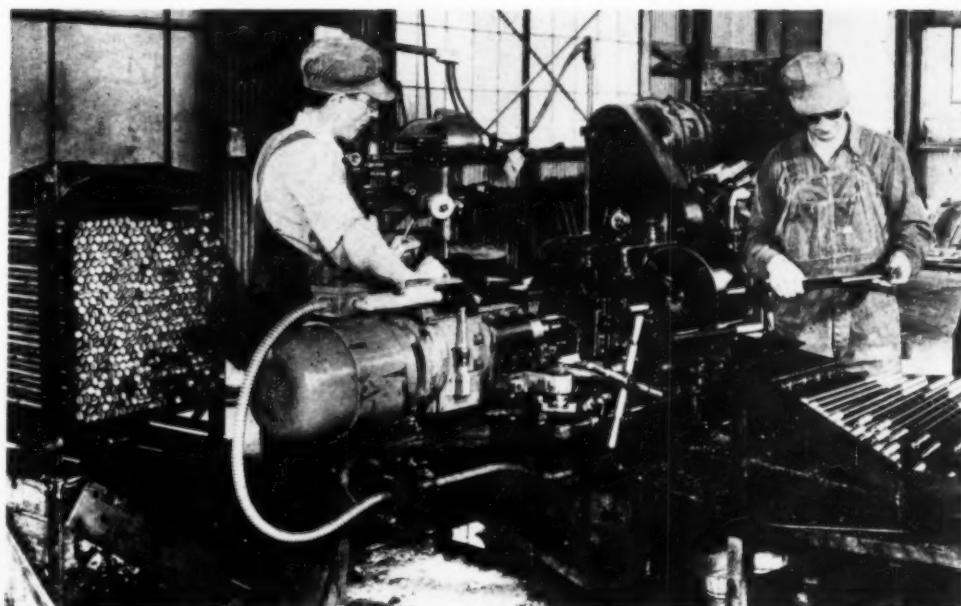
11 AT FOOT OF SIDE SLOPES, diagonal braces confine expansion movement to central section containing expansion joints.

She-Bolts for Concrete Forms Made at Two-per-Minute Rate

AT SHASTA DAM about 100,000 steel bolts will be used to anchor form panels to previously poured concrete blocks. The large number of these fastenings, which are known as she-bolts, is required because the simplest procedure is to have these anchorages imbedded in the concrete of each pour and to leave them there. This means using a new set for each succeeding form setup. It was believed cheaper to make up these bolts on the job and accordingly the contractor designed and assembled in the shop at Shasta Dam a novel machine shown in the accompanying picture, which performs five machining operations on each bolt and turns out the finished product at the rate of two per minute.

The major parts of the assembly that performs these functions are standard machines; principally Delta Manufacturing Co. 17-in. automatic-feed drill

(Continued on page 80)

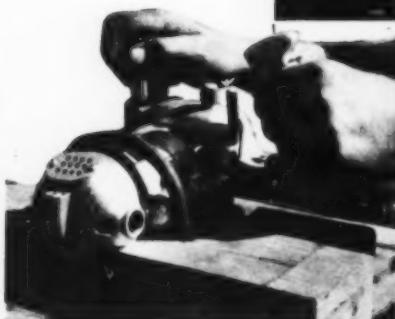


THIS MACHINE, assembled by contractor on Shasta Dam job, turns out she-bolts for anchoring form panels and does it on creditable quantity-production basis.

SMALL TOOLS ON CONSTRUCTION



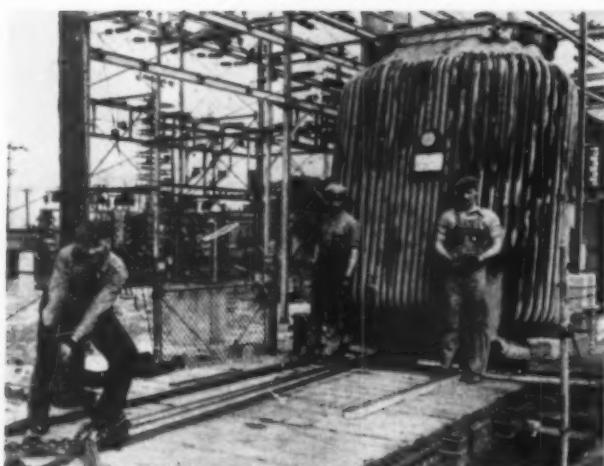
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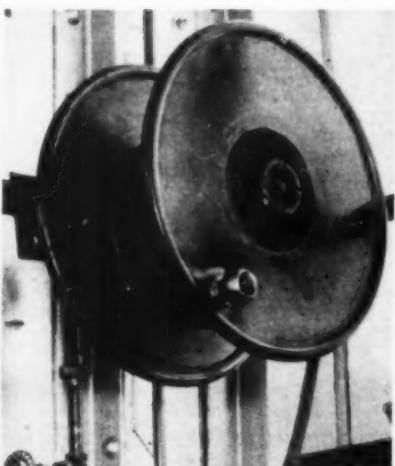
1



1 UNUSUAL METHOD OF FINISHING CONCRETE surfaces in cramped quarters at Grand Coulee dam, in Washington, is employed by Consolidated Builders, Inc. by mounting Chicago Pneumatic vibrator on rectangular base plate.



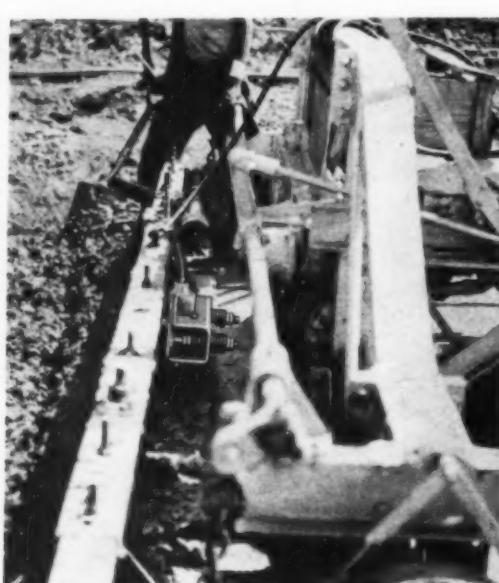
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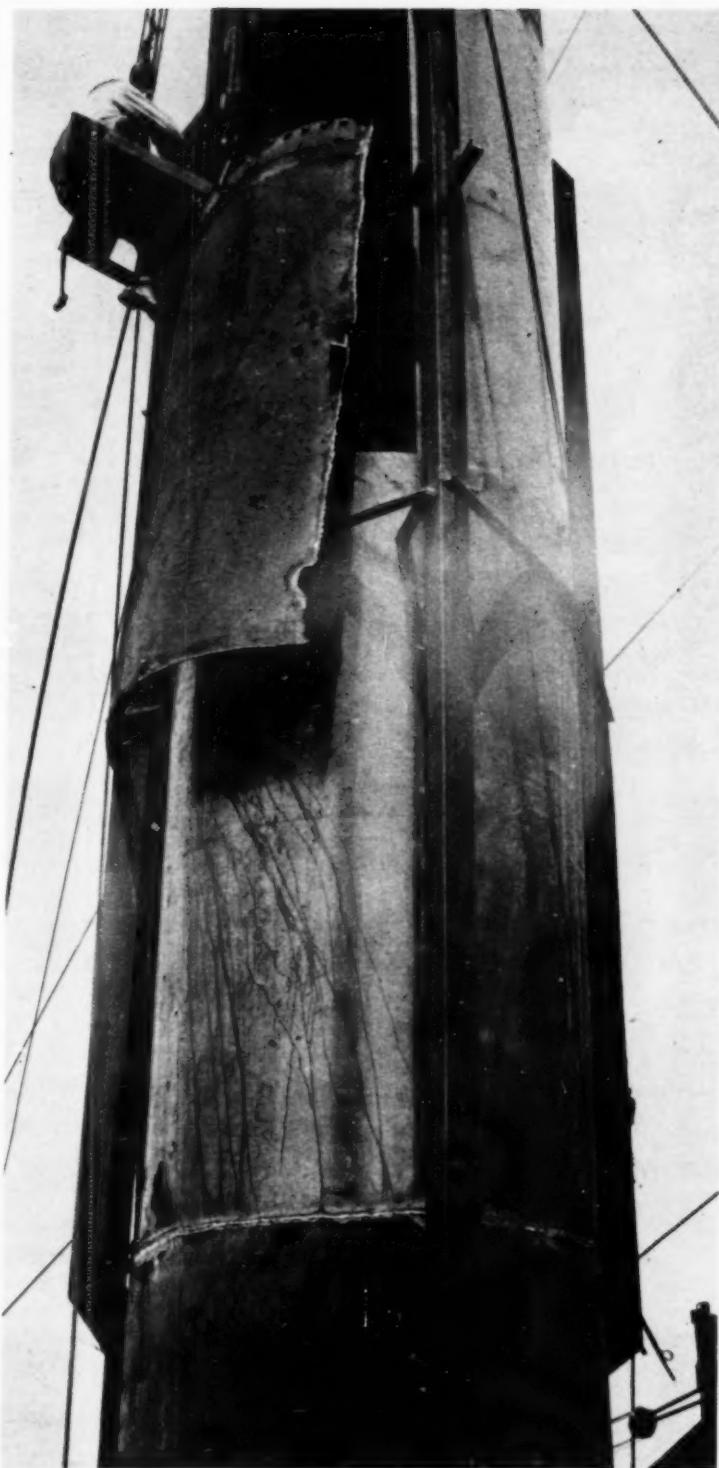
2 BEVELED EDGES ON WOOD DOORS are obtained by Barrett & Hilp, contractors on California's Sunnydale housing project, by mounting Mall portable electric plane (right) in fixed position. Mounting is adjustable, as to height above base, by slots in uprights to accommodate doors of different widths. When passing under planer (left) door is given desired bevel on outer edges, thus saving carpenter's time in hand finishing.

3 LOADING OF HEAVY TRANSFORMER on railway flat car with ramp on end is handled easily with Coffing ratchet hoist. Equipped with alloy steel Diamond chain, tool weighing only 59 lb. moves weight of 60,000 tons.

4 LIVE HOSE REEL is designed for use on Schramm portable and stationary air compressors. Fits any 1½-in. female pipe thread and has built-in valve inside reel with bronze bushings to insure free turning under all conditions. Reel is designed so that any length of hose from 3 to 50 ft. can be pulled out for use; opening of valve allows air or water to enter hose.

5 PIPE-PULLING JACK loosens and backs out old water service connection at south-side housing project in Chicago. Simplex unit, with 2½-in. screw and handy ratchet has "break-away" power of 20 tons. Pawl and rack lever action insure fast backing out of pipe after it has been loosened.

6 VIBRATING UNIT, powered by electric generator driven by gasoline engine, is mounted in horizontal plane on back of screed of machine for finishing concrete pavement. Machine makes two passes over concrete. On first pass leveling off of dumped concrete and pushing it into place is facilitated by vibration of screed which increases workability of batches and insures dense concrete mix without voids or pockets. On second pass machine puts final smooth finish on pavement surface. Vibrator is Syntron unit.



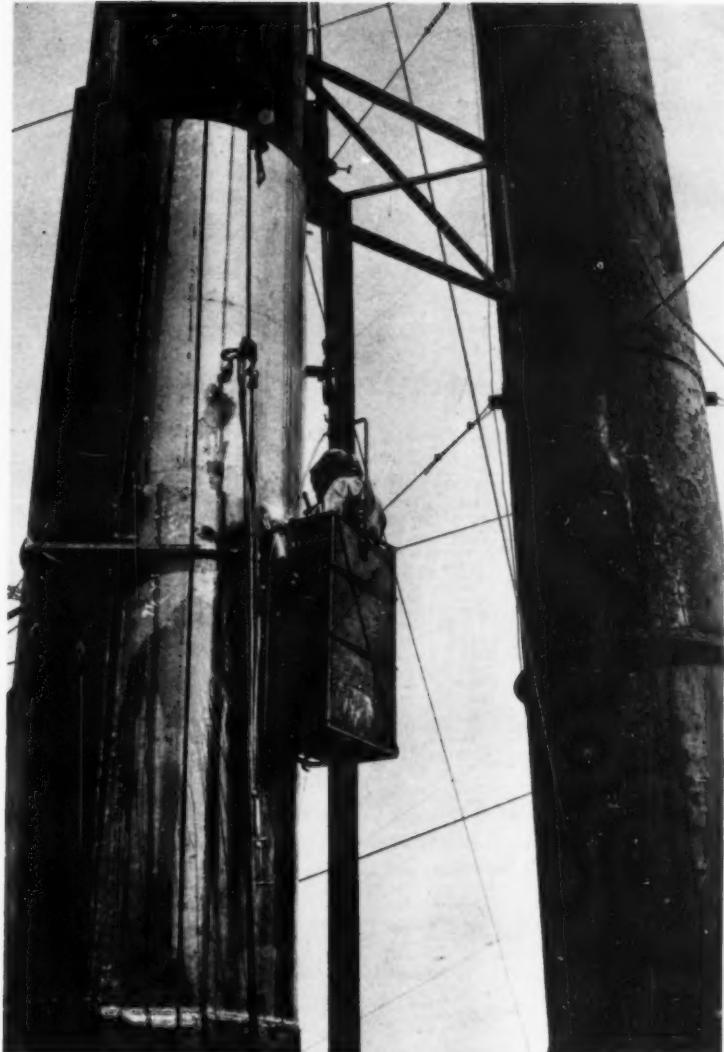
CORRODED PLATE IS REMOVED from 75-ft. steel stack by flame cutting. Welded steel angles support upper portion of stack while repairs are in progress on damaged section.

BELIEVED TO BE THE FIRST OF ITS KIND ever attempted, an electric welding job has saved a large public utility company from a possible plant shutdown with its accompanying financial loss, plus the additional cost of entirely new boiler stacks. A 200-amp. Westinghouse FlexArc welder repaired for less than one-third the estimated cost of new stacks, the two badly corroded 75-ft. steel stacks.

Engineers upon inspecting two of the company's three 20-year-old steel stacks found that the $\frac{3}{8}$ -in. thick steel center plates had been corroded down to as little as $1/64$ in.; in some places they found a full $1/4$ in. of rust. Cause was the corrosive action of combustion products from the forced-draft, coal-fired boilers. The company called in the Weldrite Corp. to repair the stacks, if possible.

To solve the problem of supporting the top half of the stack so that the corroded plates could be removed, offset steel angles were welded across the faulty section. The old plates

CORRODED STACKS SALVAGED BY *Electric Welding*



NEW CENTER SECTION PLATES are welded in place on 75-ft. stack, with aid of 200-amp. Westinghouse welder. Job involved use of 200 lb. of $5/32$ -in. electrodes.

were cut out, leaving the stack's upper portion supported only by the angles. It is believed this is the first time such a method of support has been employed for a welding job of this kind.

Eight new 9x4-ft. steel plates, $\frac{3}{8}$ in. thick then were welded in place on each stack. Vertical overlaps of 3 in. were employed at the junctures of the old and new steel.

During the time the center section plates were out, the boilers were shut down, but before completion of the welding, they had been re-fired. Had a new brick chimney been built, or new steel stacks provided, the boilers would necessarily have had to shut down completely while breeching was being installed or stacks were erected. Cost of repairing the two steel stacks by welding was done at less than one-fifth the estimated cost of a new brick structure, taking no account of the expense of the shutdown which would have been necessary.

Present and Accounted For

A PAGE OF PERSONALITIES



CHIEF OF ENGINEERS, U. S. Army, MAJOR-GENERAL JULIAN L. SCHLEY (center) inspects outlet works for Clearwater dam under construction near Piedmont, Mo., by United Construction Co. of Winona, Minn. Accompanying Gen. Schley are LIEUT.-COL. S. L. SCOTT (left) acting division engineer, and MAJOR T. F. KERN, assistant to district engineer, Little Rock (Ark.) District.



AT CHEROKEE DAM, newest TVA project on Holston River 35 mi. northeast of Knoxville, Tenn., construction responsibilities will rest upon (left to right): **GEORGE K. LEONARD**, construction engineer, **G. E. MURPHEY**, construction superintendent, and **LEE G. WARREN**, project manager.



PROMOTED to be assistant chief engineer of U. S. Bureau of Reclamation is **WALKER R. YOUNG**, supervising engineer of Central Valley project in California (including Shasta and Friant dams) and previously construction engineer on Boulder dam. Mr. Young joined Reclamation Bureau as assistant engineer in 1911.



NOMINEE FOR PRESIDENT of Associated General Contractors of America, to take office after annual convention in Houston, Tex., Feb. 17-19, 1941, is **M. W. WATSON**, highway and bridge building contractor, of Topeka, Kan. Mr. Watson is at present vice-president of A. G. C. and chairman of its Highway Contractors Division.



NEWLY ELECTED GOVERNOR OF MICHIGAN is **MURRAY D. VAN WAGONER**, state highway commissioner and past-president of American Road Builders' Association. Commissioner Van Wagoner won Nov. 5 election by majority of about 100,000 votes.



NEW MANAGING DIRECTOR of Associated General Contractors of America is **HERBERT E. FOREMAN**, appointed to fill vacancy in that post created by recent death of E. J. Harding. Mr. Foreman has been a member of A.G.C. staff in Washington, D. C., since 1929 and until his recent promotion was assistant managing director. He is a native of Dayton, Ohio, and a graduate of Ohio State University.

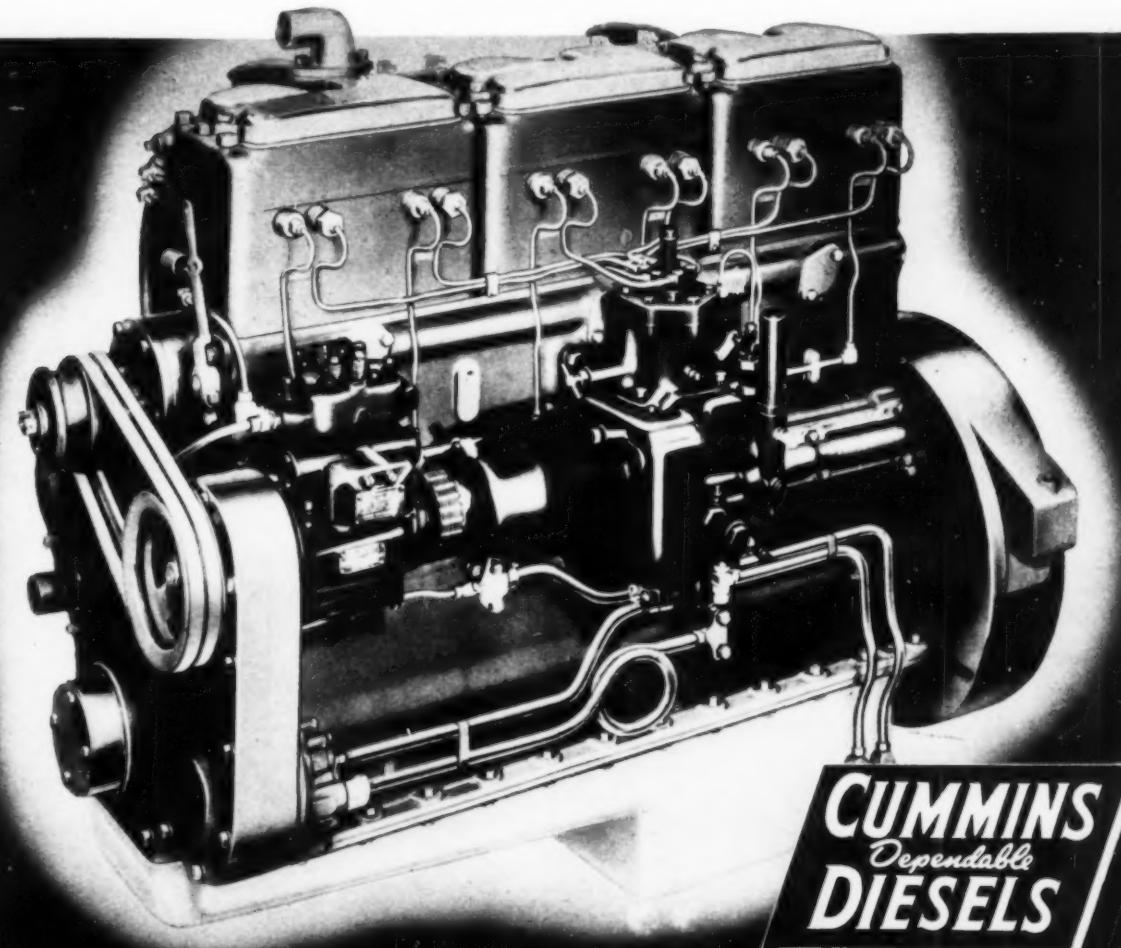


A GLUTTON FOR PUNISHMENT

EXAMPLE: Kessler Construction Co., Mt. Carmel, Pa., uses this Walter truck, powered with a 150 hp. Cummins Diesel, to haul rock on a highway construction job. Rig hauls 20 tons, making 20 trips per 7-hr. shift over a 1½-mile round trip run having an 8½% grade. Fuel consumption averages about 14 gallons per shift. Company operates 4 other Cummins Diesels, in shovels, truck and coal separating plant.

BELow: Model HB-600 Cummins Dependable Diesel. Horsepower: 150 at 1800 rpm. Displacement: 672 cu. in.

The Cummins Diesel's tremendous capacity for work . . . its ability to take the punishment dealt out by back-breaking jobs and still come back for more, is one of the outstanding reasons why there are 101 Cummins Diesel-powered trucks and tractors working on three of the country's largest and toughest construction projects . . . one of the big reasons why these contractors are getting extra yardage, extra loads with Cummins Dependable Diesels. This extra yardage . . . these extra loads, plus lower fuel and upkeep costs, account for the top profits Cummins Diesel power is making for leading contractors everywhere. Cummins Engine Co., 1716 Wilson Street, Columbus, Indiana.



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JAEGER, ALONE, Gives You All These Pumping Features

JAEGER "PRIMING JET"—Up to 5 times faster priming and re-priming—often means difference between profit and loss on job. No adjustments—no need to "gun" engine.

POSITIVE RECIRCULATION CUT-OFF—It's controlled by flow, not pressure.

"FULL-RANGE" IMPELLER gives high efficiency under all conditions (built of steel in 4" to 8" sizes).

ACCESSIBLE SEAL — always outlasts the impeller.

PATENTED SELF-CLEANING SHELL — scours while pumping, won't clog, easily accessible.

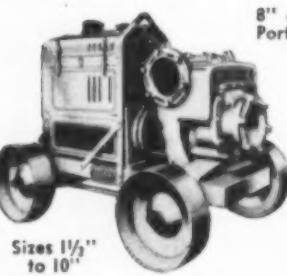


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Factory—3000
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Compact 2", 3", 4" and 6" Sizes—Heavy Duty and Intermediate Types.

8" and 10" Sizes, Most Portable Big Pumps on Market—Capacities to 220,000 G.P.H.

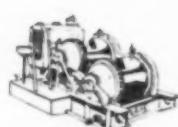
Convertible Jetting - Dewatering Pumps (Two Pumps in One). Vertical Caisson Pumps, Well Point Systems, Triple Road Pumps.



Sizes 1 1/2" to 10"

MIXERS
Tilting, Non-Tilt, 3 1/2 to 565

HOISTS
6 to 100 H.P.



THE JAEGER MACHINE CO.
800 Dublin Ave., Columbus, Ohio

CONSTRUCTION EQUIPMENT NEWS

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Review of Construction Machinery and Materials for DECEMBER, 1940

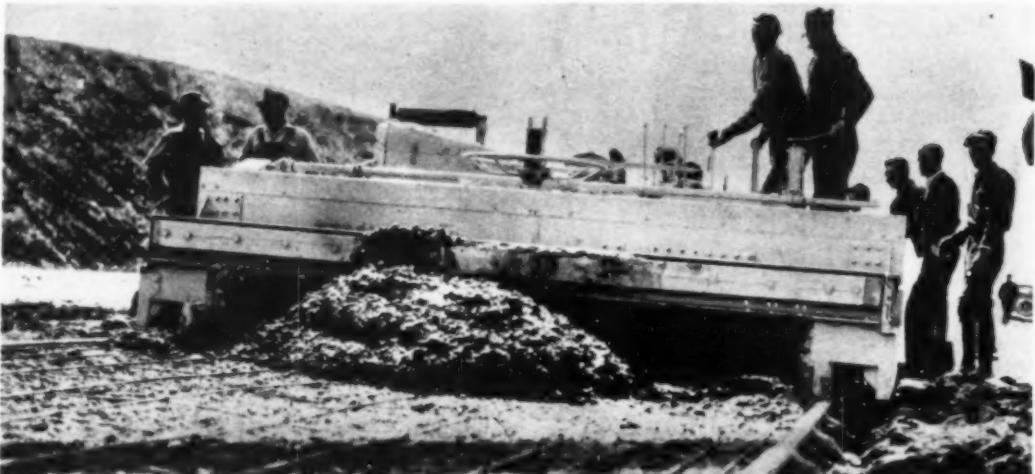


FOUR-WHEEL-DRIVE TRUCK SHOVEL $\frac{3}{4}$ - and $\frac{1}{2}$ -yd. capacities, is mounted on special Michigan chassis and is said to be quickly converted to crane, dragline, clamshell or trench hoe. Addition of front-wheel-drive axle claimed to increase shovel's maneuverability without decreasing mobility on highway. Constant velocity joint on front axle said to increase ease of steering. Operator's controls conveniently arranged. Boom has full circle swing. Air clutches handle boom and swing mechanism. Truck chassis permits low center of gravity, said to add stability to machine. High tensile alloy steel chassis frame. Optional gasoline or diesel power available. Drum shafts and turntable rollers, ball bearing equipped. Tires, 10.50x20 in. with Lockheed hydraulic brakes on all wheels.—Michigan Power Shovel Co., Benton Harbor, Mich.

★ ★ ★

PAVING SPREADER for automatic spreading of concrete for pavements, has as its key feature spreading blade which acts in same manner as trowel spreads mortar, moving concrete forward as well as distributing it laterally. Spreader said to be built and braced to handle tough jobs and to be de-

bed said to be filled to proper thickness and grade without regard to operator alertness or control and without necessity for intermediate handling, thus reducing power and tractive effort required. Both spreading blade and strike-off said to be quickly adjustable for levels below forms to accommodate



signed to handle low slump concrete with speed and ease, easily accommodating maximum production of 34E paver. Machine, driven through automatic type unit transmission, is provided with three speeds, 11, 20 and 122 f.p.m., for both reverse and forward travel on units up to 14 ft. wide and 8, 14 and 19 f.p.m. on wider spreaders. All parts of road

laying steel mesh in two-course work. Spreader also can be furnished with composite unit consisting of strike-off plate and vibrator for vibrating both courses. In service to date, manufacturers claim spreader has produced approximately 300 lin. ft. of slab 12 ft. wide and 9 in. thick, two-course work, per hour.—Blaw-Knox Co., Pittsburgh, Pa.

READY TO DIG IN FOR AMERICA'S DEFENSE

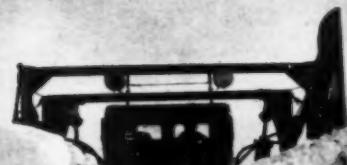
Baker Tractor Equipment is ready for its important part in speeding up the defense program. Big Baker Bulldozers and Gradebuilders, busy Hydraulic Scrapers and powerful Road Rooters are already diligently working on the sites of many great defense projects. Baker Snow Plows are waiting to clear the way for the transportation of materials so that precious winter hours may not be lost. For 32 years Baker has maintained a leading place in the industry. Now, when there is greatest need for its products, we are making every effort to provide equipment which contractors for defense must have.

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SNOW PLOWS



GRADEBUILDERS

★ **BAKER TRACTOR EQUIPMENT** ★

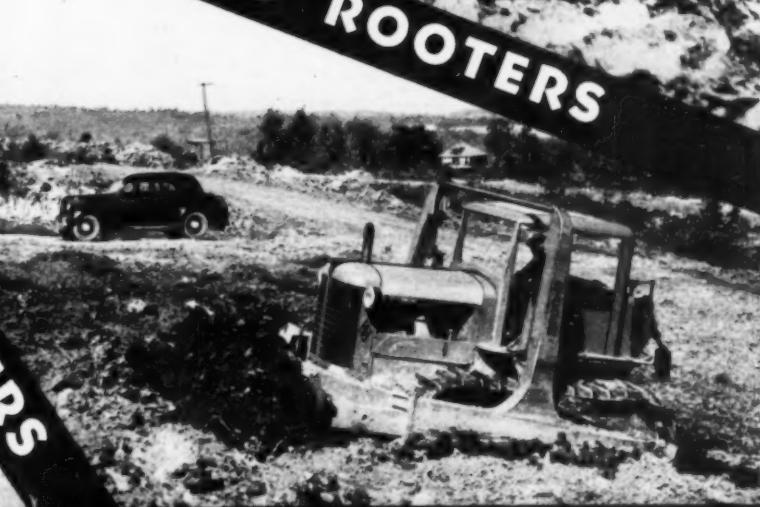
HYDRAULIC BULLDOZERS



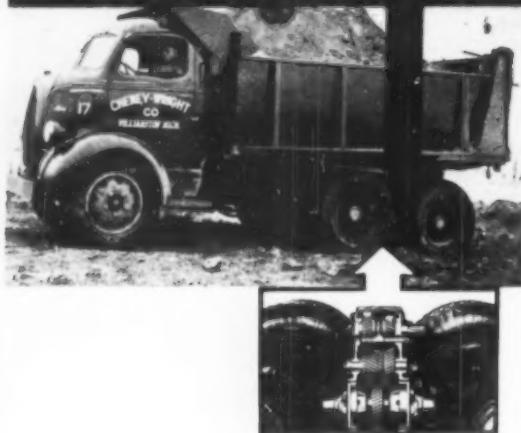
HYDRAULIC SCRAPERS



ROAD ROOTERS



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TRACTION . . . NOT POWER ALONE IS WHAT YOU NEED

YOU SAVE MONEY! Take a truck of $1\frac{1}{2}$ to 3 tons original capacity and let us quickly and at a low cost convert it to a husky unit of 30,000 lbs. or more gross vehicle weight capacity.

Two ratios, for power and speed, easily controlled by a lever in the cab. Walking-Beam Flexibility — Special spring construction keeps equal load on all four driving wheels — and balanced power.

SPRING ASSEMBLY

Thornton spring suspension is one of the finest contributions to truck design. Massive dual springs, multi-leaf type, are center pivoted on the projecting ends of trunnion tubes which extend from transfer case through brackets on each side-frame. At their ends, these dual springs are mounted by rotatable shackles to the axles. This affords maximum useful flexibility. Axles are ideally spaced for easy turning, reduced tire scrub, proper load support and road and load shock absorption.



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Manufacturers also of the THORNTON automatic-locking DIFFERENTIAL which gives traction when slippery going makes trucks equipped with ordinary differentials helpless.

When you need TRACTION you need THORNTON

DESIGNED FOR HEAVY HAULING is new series of Mack truck, tractor and six-wheel models which are said to combine sturdiness of construction with modern streamlined styling. Included in series are two truck units, three tractor models for tractor service, and three six-wheelers. Truck and six-wheel models are offered in variety of wheelbase lengths, while tractor models, besides their standard wheelbase length, are available in special wheelbase length for sleeper cabs. Trucks are powered by 6-cylinder Mack Thermodyne engine developing (1) 118 hp. at governed speed of 2,500 r.p.m.; (2) 131 hp. at speed of 2,400 r.p.m.; (3) 142 hp. at speed of 2,200 r.p.m. (optional); (4) 131 hp. at speed of 2,000 r.p.m. (Mack Lanova diesel). Tractors powered by



engines Nos. 2 and 3 above, with diesel power optional. Six-wheelers powered by Nos. 2 and 3 as standard, and by other engines, including diesel units, as optional. All engine crankshafts have seven main bearings, are fully counterbalanced on every throw and are of drop-forged, case-hardened, low carbon steel. Drives are through single plate clutches through either 5-speed direct or 5-speed overgear transmission. Choice of 5 rear axle ratios offered with each model. Six-wheelers all use four-wheel-drive bogie balanced so that loading of tires is equal under all conditions. Tractor and six-wheel models have air-operated brakes. Trucks have hydraulically-operated brakes with vacuum-booster. Streamlined cabs are of all-metal construction and have slanting V-type windshields, adjustable leather upholstered seats, chromium plated windshield frames, two intake and exhaust ventilators, dual windshield wipers, dome lights, rear view mirrors, felt-lined glove compartment, coat hooks and headlight beam indicator. Shatterproof glass is standard throughout.—**Mack Trucks, Inc.**, 34th St. and 48th Ave., Long Island City, N. Y.

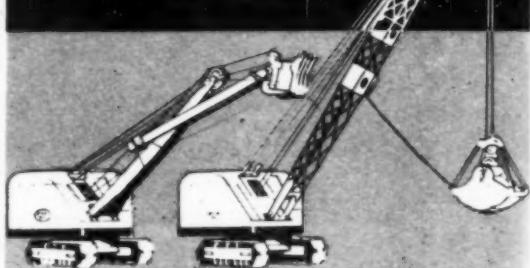
★ ★ ★

IMPROVED WIRE ROPE CONNECTOR, called "Electroline-Fiege," of vibration damping design, grips cable with graduated compression, feathering off from maximum at rear to zero at front and is said to prevent "weak point" crystallization at point of connection and to insure longer rope life. Device is compact, streamlined assembly consisting of sleeve which slips over end of wire rope, tapered plug which is inserted to separate and hold strands of



wire in sleeve and covering socket which securely locks cable. Installation may be made with ordinary mechanic's tools. Unique feature, according to makers, is "inspection hole" which enables workman to see at a glance perfection of twist joint, with complete bond between cable, tapered plug and sleeve. For rope sizes $\frac{1}{4}$ in. or larger, Standard Connector is available in black, hot-galvanized and cadmium-plate finishes. For rope sizes $\frac{1}{2}$ in. or smaller, Industrial Connector may be had in above finishes and also in bronze, stainless steel and nickel metal.—**Electroline Co.**, 4001 S. LaSalle St., Chicago, Ill.

Byers SPEED MAKES MONEY for you



"Speed" is the word on today's construction! Speedy completion of your job requires equipment capable of more than ordinary speed.

You won't have to knock the governor off the motor of any Byers to get all the speed in digging, dumping, travelling, swinging that your operator can safely use.

This is another reason why you should investigate Byers $\frac{3}{8}$ to $\frac{3}{4}$ yd. shovels and cranes.

11 FULLY CONVERTIBLE MODELS IN $\frac{3}{8}$ - $\frac{1}{2}$ - $\frac{5}{8}$ - $\frac{3}{4}$ YD. SIZES

Modern CRANES and SHOVELS

BYERS

RAVENNA, OHIO



Balanced for safety with greatest weight on long end of board!

PRICED WITHIN REACH OF EVERY CONTRACTOR

No contractor need be without one of these powerful, fast and efficient electric saws that handles every cutting job at a profit. They are beautifully streamlined, sturdily constructed and designed so that the greatest part of the weight rests on the long end of the board. Thus, they eliminate all blade binding near end of cut and assure a perfect balance for safe, one hand operation. Each model has spring safety guard, loop handle with built-in switch, and swivel base for bevel cuts to 45 degrees.

Write today for FREE demonstration and descriptive literature. Also, information on concrete vibrating and surfacing machines with interchangeable attachments.

MALL TOOL COMPANY

Successors to
WAPPAT INCORPORATED and WAPPAT GEAR WORKS
Manufacturers of former WAPPAT and ALTA products
7757 South Chicago Ave. **Chicago, Ill.**

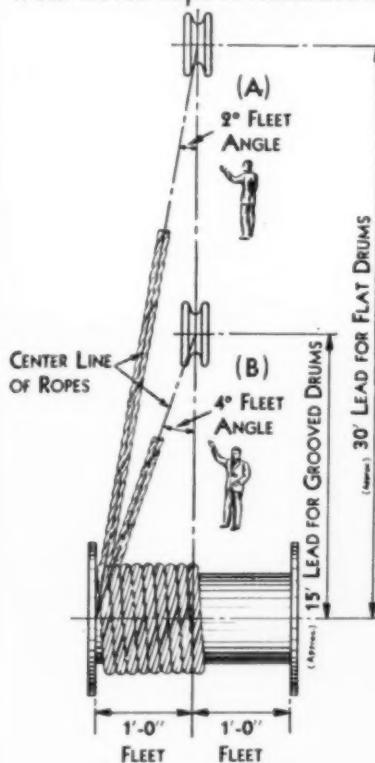
This is No. 6 in a series of informative articles for wire rope users prepared by the Macwhyte Wire Rope Company.

Avoid excessive fleet angles on your equipment

The fleet angle is that angle included between lines drawn from the center of the drum, and from the flange of the drum, to the lead (first) sheave. Both (a) and (b) below are illustrations of fleet angles.

Wire rope is often seriously damaged when this fleet angle is excessive. Side wear and severe scuffing result. Often individual wires become misplaced, bruised, crushed.

Grooved drums are damaged, too, by wide fleet angles. Ropes wear against the groove walls, grinding them down. Wear on the rope is excessive also.



WHAT TO DO

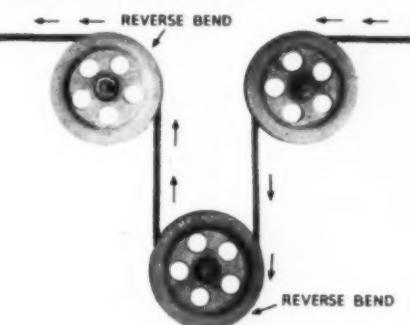
Check the fleet angles on your equipment. Keep the angle as small as possible. A fleet angle between 1° and $1\frac{1}{2}^{\circ}$ is ideal. Fleet angles as low as $\frac{1}{2}^{\circ}$ and up to 2° for flat faced drums and 4° for grooved drums are permissible for most hoisting equipment. If the fleet angle exceeds these values, then look out for excessive drum wear or poor spooling.

Guard against reverse bends

Years of experience and many tests have proved that reverse bending and excessive wire fatigue reduces rope life as much as 50%.

Where reverse bending cannot be eliminated, use the largest sheaves possible and place them as far apart as you can. By getting the MAXIMUM distance between reverse bends, you reduce fatigue—provide for longer service.

Keep sheaves aligned, too. Countless rope dollars have also been lost because sheaves are out of line.



You can detect misalignment by uneven groove wear. Keep sheaves in line. You'll save money.

MACWHYTE COMPANY
2940 Fourteenth Avenue, Kenosha, Wisconsin

Manufacturers of rope—braided wire rope slings—Monel Metal and Stainless Steel wire rope—aircraft cable, tie-rods, and 'Safe-Lock' terminals for aircraft—and wire ropes for all requirements.
New York . . . Pittsburgh . . . Chicago . . . Ft. Worth . . .
Portland . . . Seattle . . . San Francisco

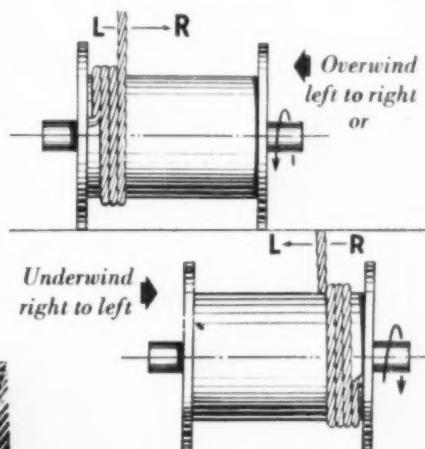
DISTRIBUTORS THROUGHOUT THE U. S. A.

Steer clear of slip-shod spooling

Make sure the rope is wound on your drum in the *correct direction*. Rope wraps will then be close to each other and in line. Rope wear will be reduced to a minimum.

If rope is started in the *wrong direction*, however, uneven winding will result. Ropes cross and crush each other, causing a "burning" and scuffing of wires.

The following drawings show correct spooling for right lay rope when observer stands behind drum looking toward the direction of rope travel:



SEVERAL LAYER WINDING

There is usually considerable wear and scuffing against drum flanges when ropes change from one layer to the next. You can offset this condition in two different ways:

FIRST, and most effective, use rope of such length that there will be only one layer of winding; or when this is not possible . . .

SECOND, use a rope of MORE than sufficient length so that a short section can be cut from the drum end occasionally. This moves up the point of wear.

Previous articles in this series are available on request on your company letterhead, also G-13 general wire rope catalog containing much helpful information.

NO. 485



Could you use a TOUGH Shovel that will handle TOUGH jobs?

This $\frac{1}{2}$ yard shovel weighing 25,000 # packs a terrific wallop that pushes the dipper through concrete and brick pavement — a TOUGH job if there ever was one. The well-balanced machinery, sturdy mounting, strong unit-cast alloy bases and powerful one-piece chain crowd puts big machine value in this small shovel. If you can use a TOUGH shovel like this, write for Copy of Catalog 25-BC.



BAY CITY SHOVELS, INC., BAY CITY, MICHIGAN

BAY CITY

SHOVELS • CRANES • DRAGLINES • TRENCH-HOES • SKIMMERS



IF YOU have a tough hauling problem — check with LA CROSSE for a trailer of the right size and type to fit the job. LA CROSSE builds the most complete line of heavy duty trailers — in a wide range of capacities for every hauling need. Built to take the heaviest loads safely. Write for complete information.

La Crosse Trailer & Equipment Co.
La Crosse, Wis., U.S.A.



COMMERCIAL

GIVES YOU EASIER,
FASTER, AND SAFER
CONSTRUCTION ON...

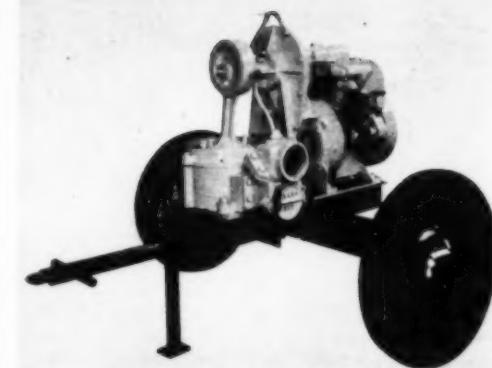
TUNNELS UNDER
RAILROAD
TRACKS



(above) One of five tunnels under N.Y.C., Main Line—Yonkers
(below) West Side Line Sewer—Bethlehem, Pa.—Dia., 5 $\frac{1}{2}$ ".

* When your contract calls for a railroad or street crossing, don't go to the expense of laying sewers and water lines in an open trench . . . the COMMERCIAL LINER PLATE method has proven to be easier, faster, and safer. With circular self-supporting liner plates, the tunnel is "holed through" in short order. Consider the savings available with a COMMERCIAL "quick crossing" tunnel . . . then write for information concerning every application of COMMERCIAL LINER PLATES . . . they'll fit any size or shape of tunnel.

**The COMMERCIAL SHEARING &
STAMPING CO.**
YOUNGSTOWN, OHIO



MOBILE DIAPHRAGM UTILITY PUMP mounted on high speed, pneumatic-tired spring mounted trailer, is recommended by its makers for emergency duty in water or sewer departments and for general utility performance. At 10-ft. suction lift, 3-in. pump has AGC rating of 3,000 g.p.h. and the 4-in. model, 6,000 g.p.h.—**Novo Engine Co., Lansing, Mich.**

★ ★ ★

PORTABLE ARC WELDER, gasoline drive, is designed not only for quick removal from place to place, but for efficient handling of heavy-duty assignments. Firmly built chassis. Sturdy portable mounting and trailing hitch are said to open up



new speeds for getting to job over smooth highways or rough terrain with minimum of delay. Counter-balanced industrial type motors, 6- or 8-cylinder, claimed to be silent in operation and free from vibration, are direct connected to welder, but remote control is available at no extra cost, if desired.—**Hobart Brothers Co., Hobart Square, Troy, Ohio.**

★ ★ ★

STREAMLINED DIESEL-DRIVEN, 500-CU.FT. PORTABLE COMPRESSOR, two-stage, air-cooled, is claimed to operate at full capacity and at 100-lb. discharge pressure at fuel cost of 41 $\frac{1}{2}$ c. per hour. Has two low and two high pressure cylinders located on each side with included angle of 90 deg. One low and one high pressure connecting rod operate on each of four crank pins. Features: Simple valves, inlet valve lubrication, multiple disk clutch, sectional intercooler. Engine speed



varies automatically in direct proportion to demand for air, between 50 and 100 per cent of compressor output. When demand for air falls below half capacity, unit is unloaded by holding open inlet valves while engine continues to run at full speed. When air consumption increases, compressor reloads at half-speed and then continues to operate at speed required. This system said to assure full load economy down to 50 per cent; to eliminate wasteful idling and frequent loading and unloading of compressor, resulting in economy and longer life. Powered by 6-cylinder Caterpillar diesel engine with 5 $\frac{1}{4}$ x 8-in. bore and stroke and with maximum horsepower of 132 at 1,000 r.p.m. Mounted on steel or pneumatic-tired wheels—**Chicago Pneumatic Tool Co., 6 E. 44th St., New York City.**

NEWS FROM MANUFACTURERS About Their Products

The publications reviewed below, will keep you posted on latest developments in construction equipment and materials available for your use

DIESEL-CRAWLER TRACTORS — **Allis-Chalmers Manufacturing Co.**, Milwaukee, Wis. (24 pp. 2 colors, illustrated). Stresses performance and protection against lost time and emphasizes five main features of 54-hp. tractor: (1) Two-cycle diesel power; (2) balanced power and speed; (3) bi-metallic clutches and brakes; (4) new track release mechanism; (5) "positive-seal" truck wheels.

★ ★ ★

EARTH-MOVING TOOLS AND TRACTOR EQUIPMENT — **The Heil Co.**, Milwaukee, Wis. (8 pp. illustrated). Photographs and descriptive captions of hydraulic and cable scoops, trailbuilders and bulldozers. Photographs of tamping rollers, snow plows, bottomless scoops and dump units.

★ ★ ★

ELECTRIC TOOLS — **United States Electric Tool Co.**, Cincinnati, Ohio. (72 pp. illustrated). Covers complete line of electric tools including buffers, grinders, drills, heat guns, nut setters, polishers, reamers, drives, sanders, saws, screwdrivers, surfacers, tapers, tire detreaders, valve seat grinders and accessories.

★ ★ ★

RATCHET LEVER HOISTS — **Coffing Hoist Co.**, Danville, Ill. (24 pp., illustrated). Covers company's complete line of hoisting equipment, including safety-pull ratchet-lever hoists with capacities from $\frac{3}{4}$ to 15 tons, spur-gear chain hoists, differential chain hoists, trolley, spur-gear gravity hoists, electric hoists, load-binders and utility maintenance tools. Photos illustrate wide range of applications. Tables of net prices and specifications.

★ ★ ★

SKIN PROTECTOR FOR WORKERS — **The Magnus Chemical Co., Inc.**, Garwood, N. J. (4 pp. folder, illustrated). Cream, called "Skin-Gard," when rubbed into skin is said to protect it against chemicals, solvents and dirt of all kinds, against dangerous infection, annoying cracks and abrasions. Workers whose skin comes in contact with solvents are claimed to find Skin-Gard beneficial in preventing removal of natural oils of skin. Comes in two grades: regular and waterproof, latter effectively protecting skin against water, acid and alkaline solutions. Folder also discusses in detail classifications, cause and prevention of industrial dermatitis.

★ ★ ★

Anti-Tank Pillbox

BUILT IN 5 HOURS

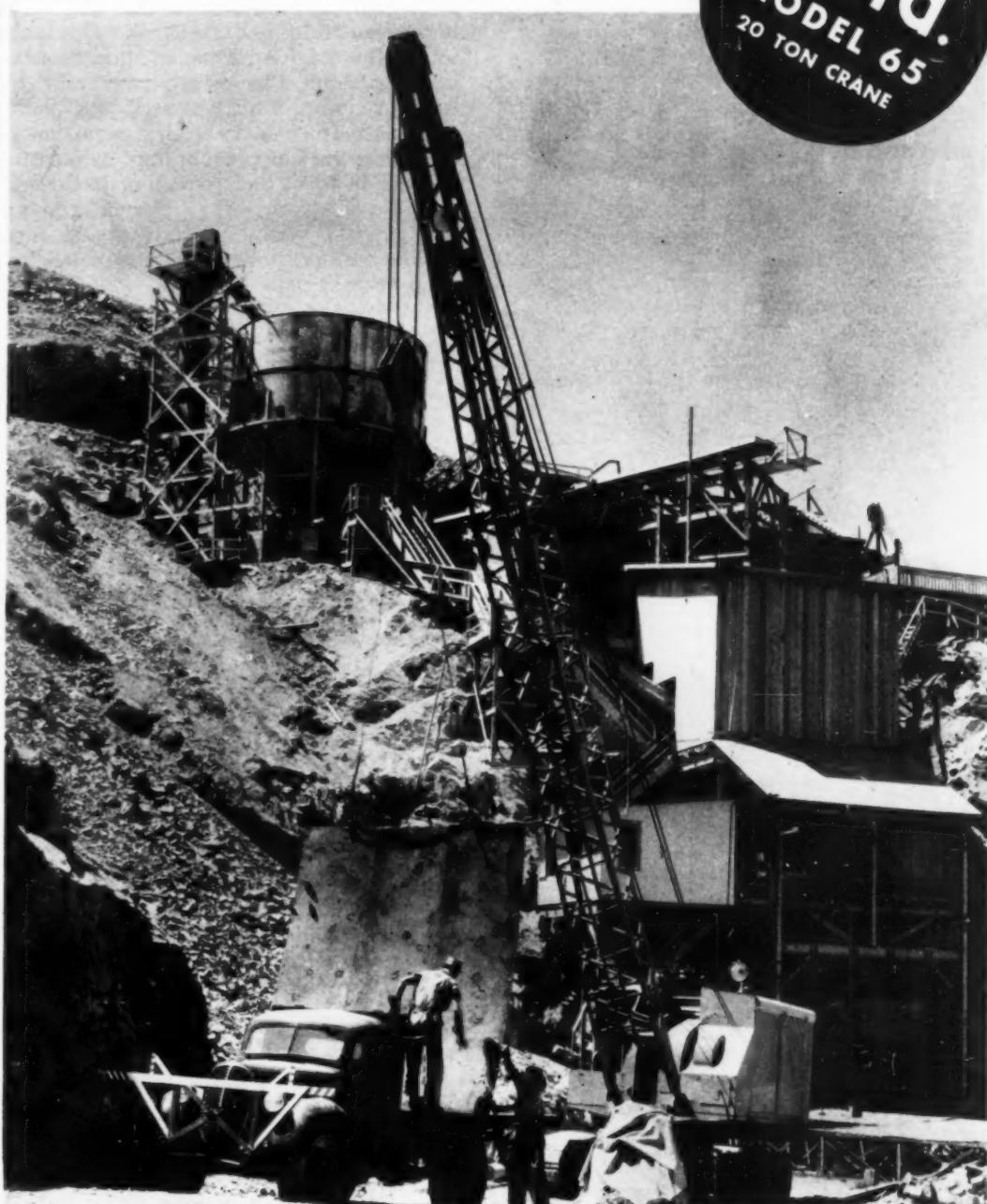
(Continued from page 62)

mounted Davey 105-c.f.m. compressor, driven by power takeoff, was used as the vacuum pump. The truck transported the forms and equipment to the job.

Upon arrival at the previously excavated site, the inside form was inflated to 4-lb. pressure and rolled into position, the sections of outside form were placed and bolted together, and a combined spreader and stabilizing ring was laid on top of

(Continued on page 76)

Added STABILITY means better Crane Service —



Here is a heavy duty crane having long, wide standard crawlers with built-in low center of gravity and added STABILITY to give higher crane ratings. More than 67,000 lbs. of effective weight is well distributed through balanced design to give you bigger returns in low-cost operation, faster speeds and higher performance.

• Long pin-connected booms and jibs up to approximately 110 feet available with Hi-collapsible-A-frame for steel setting or other special services. For use with these long booms, socketed boom cable lengths and floating bridle permit quicker and easier adjustment or dis-

mantling of boom. This construction also saves costs on cable replacement as only a relatively short boom hoist cable is used. • No matter what your crane problem, the natural STABILITY of the BAY CITY, plus the fast, easy travel and steering mechanism permitting gradual or sharp turns without stopping will give you bigger performance — better crane service. Detailed specifications and job illustrations of this 20-ton convertible crane are in Catalog 65-BC. WRITE for your copy.

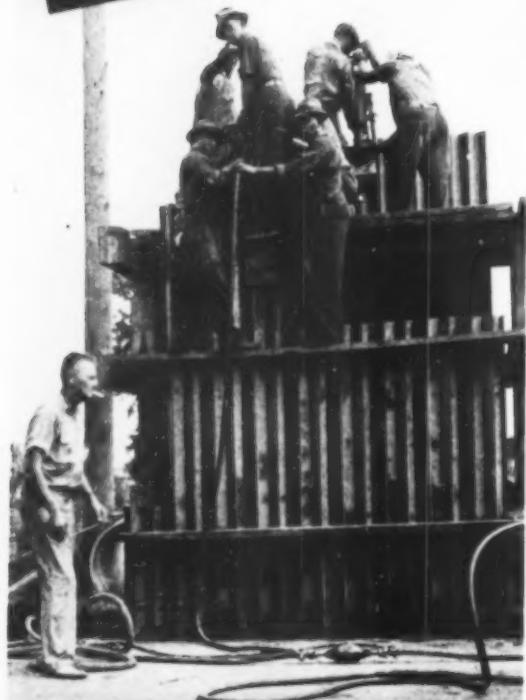
BAY CITY SHOVELS, INC.
BAY CITY, MICHIGAN, U. S. A.

BAY CITY

SHOVELS • CRANES • DRAGLINES • TRENCH-HOES • SKIMMERS

THIS STURDY SHEETING

drives fast,
pulls easy



Unskilled local labor was used to drive this ARMCO Sheeting on an important sewer project. Costs were low and the job was done quickly.

- You'll find some cost-saving possibilities in **ARMCO** Sheeting as compared to heavy, bulky timber sheeting.

For one thing, these sturdy metal sections are easy to pull and can be used again and again. This means you need less sheeting on large jobs. On small jobs you save by moving the sheeting from one project to another, thus reducing the cost of new material.

And ARMCO Sheeting is easy to handle. The corrugated design provides safe strength with no excessive weight. A small displacement area makes for fast, low-cost driving. ARMCO Sheeting can be driven to full penetration before excavation is started, thus speeding installation and lowering costs.

Three designs are available in a range of gages to meet different job requirements. You can buy the exact weight and type you need for trenches, cut-off walls, ditch checks, cofferdams and similar projects. Write for prices and complete information. **ARMCO DRAINAGE PRODUCTS ASSN.**, 5054 Curtis St., Middletown, Ohio.



ARMCO SHEETING

(Continued from page 75)
the inside form. Erection of forms took 1 hr.

Concrete then was placed in the forms, a weak gypsum cement mix being used as temporary filling for the gun slits. When concrete had been placed to the top of the outside forms, vacuum processing was begun. Placing concrete and processing required 3 hr. The stripping operation, accomplished in 1 hr., consisted of removing the top vacuum mat, exhausting the inside form and removing it through a 2-ft. trench under the pillbox, and unbolting and removing the outside form sections. Construction was completed in a total elapsed time of 5 hr.

LINE CONSTRUCTION METHODS FOR Rural Electrification

(Continued from page 45)

shows a general view of one of these machines. Being tractor-mounted, it can be effectively used in rugged country. The digging auger is supported by a boom that can be quickly brought into position, without requiring careful aligning of the tractor. Although the use of a machine of this type might not result in an appreciable saving in actual digging cost, the saving in time is often very important.

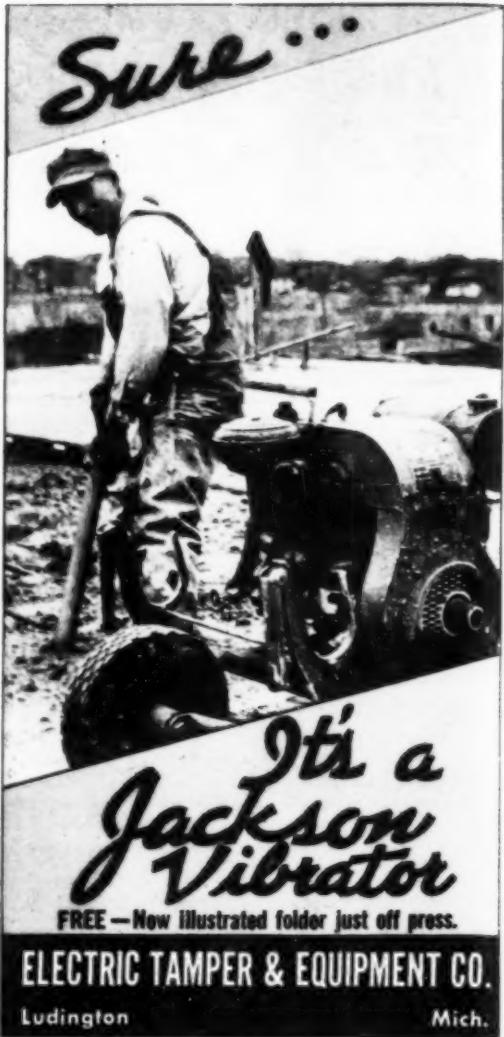
Because REA lines are being constructed in nearly all of the states, a wide range of soils is encountered. In some parts of Texas, as well as in many places in Montana and Wyoming, a stratum of cemented gravel is found where the digging of a proper hole often requires the use of air compressors and jackhammers. Furthermore, in many parts of the country, rock makes the use of power drilling necessary. Air compressors and jackhammers (Fig. 8) are, therefore, essential items of equipment when lines are to be constructed in areas where rock or other hard strata will be encountered. A light, portable compressor, large enough to supply one jackhammer, has been found to be a desirable size for REA work. Mounted on a two-wheeled trailer, it is easily pulled behind a light truck or passenger car.

Handling Poles

Most poles come to REA projects with the REA standard framing, but it is always necessary to drill additional holes to accommodate special fixtures. This cannot be properly done until the pole arrives at its destination in the field. A 32-volt, d.c. electric drill for boring these extra holes, driven by storage batteries or a 32-v. generator, is good equipment to use for this work.

Unloading and handling of poles are

(Continued on page 78)

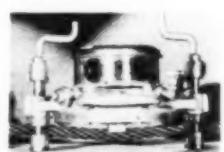


PLenty 'A S-T-R-E-T-C-H YET !

With a Martin-Decker Tension Indicator checking the wire lines and cables on your job, you can be sure of greater safety in *any* emergency. For with this instrument you can eliminate overloading . . . putting on every line the *right* tension to insure a high safety factor.

The Tension Indicator, *without paper calculations and without dead-ending*, tells the exact load in pounds as it falls on the line. Quick, accurate, you just clamp it on and read the dial. It indicates strong steady pulls, as well as sudden impact loads that do the damage but are so hard to calculate. It insures higher safety, greater efficiency and longer life from every cable on the job that carries a load.

Made in three models—Miniature, Standard and Heavy Duty for all lines up to $2\frac{1}{4}$ ", capacity 260,000 pounds . . . all models adjustable for temperature changes.



MARTIN DECKER CORP.
LONG BEACH, CALIFORNIA
MANUFACTURERS OF THE WORST INDICATORS
AT YOUR DEALERS OR FIELD AGENTS

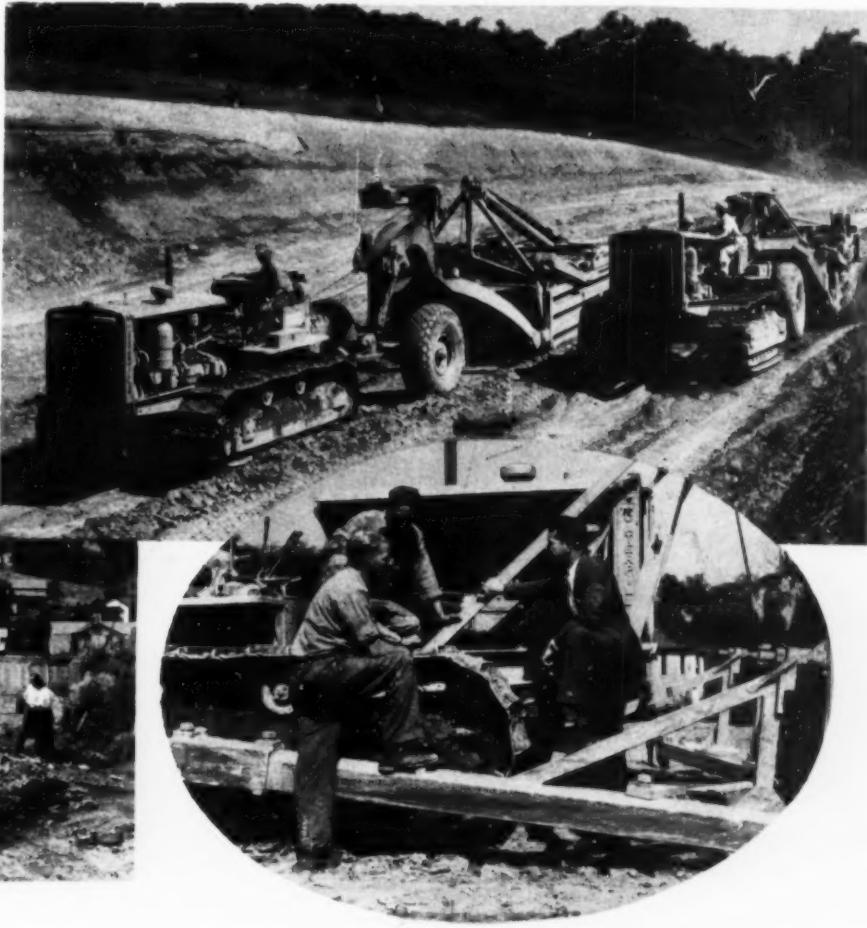
"THANKS TO *Gulfpride-*

this heavy equipment is in PERFECT OPERATING CONDITION after 4000 Hours of Hard Work"

... says Supt. on Booth & Flinn Company Job

Booth & Flinn Company's Diesel tractors are examples of the savings GULF PERIODIC CONSULTATION SERVICE can effect in operation of equipment of this kind. Their total operating hours run well over 4000, without replacements of any nature. Gulfpride is used exclusively for all this contractor's equipment.

"The Diesel engine in this shovel has been in operation for more than 3800 hours," says the operator, "and we've had no mechanical difficulties. Thanks to Gulfpride, it is still in fine condition."



"From the first day in service . . . we've stuck to the Gulf Engineer's practical lubrication recommendations . . . NO MECHANICAL DIFFICULTIES . . . AND NO TIME OUT!"

"Gulf Periodic Consultation Service is of great value to a busy contractor," says the Superintendent of Equipment on this job. "In the stress of work schedules, we sometimes overlook the important part lubrication plays in the speedy completion of a job. With Gulf's high quality lubricants on the job, we are assured of high lubricating efficiency and low maintenance expense."

Are you taking full advantage of the cooperative service the Gulf engineer is ready to extend to

you? He has had broad experience with equipment similar to yours and can give you valuable suggestions for improved lubrication practice. Result: low-cost operation and peak efficiency from *all* your equipment.

No matter where your job is located, Gulf quality lubricants are quickly available to you through 1100 warehouses located in principal distributing points in 30 states from Maine to New Mexico. Write or 'phone your nearest Gulf office today.

Booth & Flinn Company, well known Pittsburgh contracting firm, is doing a big earth-moving job on the new McMurray Road project—main artery from Pittsburgh to Washington, Pa., and Wheeling, W. Va.



Gulf Oil Corporation — Gulf Refining Company
3813 Gulf Building, Pittsburgh, Pa.

Please send me my copy — no charge — of the booklet "GULF PERIODIC CONSULTATION SERVICE."

Name.....

Company.....

Address.....

(Continued from page 76)

There's a **HAISS BUCKET** for Every Kind of Job



All sizes available. Wire or write for prices. Descriptive Bulletins on request . . . Buckets in stock at New York, Hartford, Philadelphia, Harrisburg, Baltimore, Atlanta, Birmingham and Los Angeles.

GEORGE HAISS MFG. CO., INC.
139th St. and Canal Place, New York, N.Y.

operations that may require the services of several men unless the contractor is properly equipped. At one time the most nimble man of the crew was selected to cut the last wire holding the poles on the car, and the poles were allowed to spill from the car. Careful construction men, looking for safer methods, have adopted the policy of using slings of cable around the car of poles, thus enabling them to be eased gently on to skids from the bed of the car to the pole pile or truck. Fig. 9 shows one contractor's ingenious method of loading or unloading poles; Fig. 10 presents a view of his truck and pole trailer with a full load of poles. Three men can load a truck in a fraction of the time required without such equipment.

Some contractors have found that a machine to pick up the conductors after they have been strung out on the ground and place them on the crossarm or other pole fitting can be used with excellent results where roadway construction and other conditions are favorable. Several types of such machines have been developed by contractors on REA projects. One type is now being manufactured by an equipment company in the Middle West. Figs. 11a, 11b and 11c show a general view of this particular machine and also illustrates the principle on which it works. This type of equipment is best adapted to an area where there is a minimum of trees and conflicting utilities to interfere with the operation of the boom. If the trees are small and located between the road and the poles, the boom will reach over the tops and thus speed the work. One contractor built a machine of this type, combined it with his reel truck, and was able to string the wire and lay it up on the crossarms in the same operation.



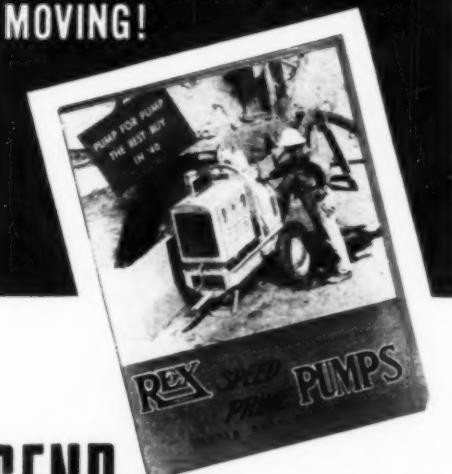
Fig. 14 . . . PLUMBING POLES and backfilling of holes is final operation after erection with derrick.

T.V.A. Photo

Fig. 12 shows one contractor's method of insuring a sufficient supply of wire for several hours of stringing. The use of this multiple-reel truck greatly reduces the delay occasioned by reloading reel trucks

TO **CONTRACTORS**

WHO WANT THE FACTS ABOUT LOW COST WATER MOVING!



SEND FOR THIS BOOK TODAY

FACT NO. 1: Only Rex Speed Prime pumps offer you the "air-peeling" advantages of the famous Rex Z-Metal Peeler!

Made of Rex Z-Metal, the impeller on Rex Speed Prime pumps is more resistant to corrosion and abrasion, at least 25% stronger than impellers made of good, malleable iron!

FACT NO. 2: The Rex recirculating valve absolutely prevents any costly recirculation of air when the pump is priming!

FACT NO. 3: These three features form a combination that gives the Rex the fastest prime, size for size, lift for lift, of any contractor's pump on the market!

Fast prime and the ability to prevent costly recirculation of air mean more gallons per hour, at lower cost per gallon! It's worth investigating, isn't it? Then send today for the free book pictured above which will give you the complete story on Rex Speed Prime pump's design and performance. Address Chain Belt Company, Dept. P-12, 1664 West Bruce Street, Milwaukee, Wisconsin. Ask for Bulletin No. 365.

BUY REX AND BE RIGHT!
PUMPS

in the field. Another truck and trailer for stringing out primary conductor is illustrated in Fig. 13. Fig. 14 shows how plumbing and backfilling is done after erection of poles.

During the wire stringing and up to the time of energizing the distribution system the field telephone may be made to play its part in construction. By attaching the telephone instruments to the conductors, communication can be had, thus synchronizing the activities of the several crews which are then in the field.

Crew Organization

The amount of construction work required to fulfill the purposes of the REA Act has made necessary the adoption of mass-production methods and procedures. To meet such demands, construction forces building a project have been broken into several crews, such as right-of-way clearing crew, hole digging crew, wire stringing crew and others, the activities of each of which must be coordinated with those of all other crews. Work must be carried on according to schedule so that the several operations can be started and completed in the proper chronological order.

By observation and study the relative or weighted value of each operation has been carefully determined and contractors are urged to work on a schedule based upon these values. REA engineers have worked closely with consulting engineers and contractors in the establishing of schedules of operation to fit the majority of projects. After construction of a project is begun, progress is reported to REA engineers each week, thus enabling them to follow closely the activities of the contractor.

The proper scheduling of the work on each project, the scheduling of the delivery of materials and the coordination of the activities of all parties concerned with matters relating to construction are some of the chief factors that have made possible the building of rural lines at progressively lowered cost. Thousands of miles have been constructed, with a definite downward trend in the unit cost, and much of this reduced cost comes about through the fact that contractors are working more efficiently. They have taken advantage of mass-production methods and are using the data with respect to job schedules that have been prepared by REA engineers. All of this, augmented by their own experience, is proving to be valuable in efficient and economical construction of REA lines.

Although REA-financed line construction costs have been steadily reduced, it is interesting to note that regulations governing minimum wages and maximum hours are always observed. Another point of interest is the safety practices which are adopted by contractors, project engineers and borrower's organizations. The REA is constantly active in promoting high standards of safety and working conditions. The result is that the number of accidents for the man hours worked is surprisingly low and this has had its effect in helping reduce costs.

This cost-reducing process and achieve-
(Continued on page 80)



SAFE FOR HAZARDOUS WORK

Occupational hazards can be greatly reduced by insisting that your workers use safe wrenches. Both Williams' Structural and Construction Wrenches are designed for safety as well as utility. Deep, accurately machined openings reduce danger of slippage. Skillful drop-forging from selected steel provides unusual strength. Both patterns are made in carbon and alloy steels, in a full range of sizes up to 2" opening.

All Williams' Wrenches are fully guaranteed and are sold by industrial distributors everywhere. Write for free booklet "How To Select And Use Wrenches."



For greater dragline yardage use a Page Bucket on the job!



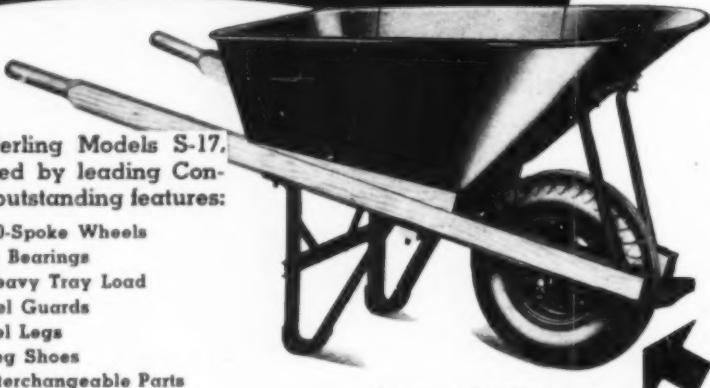
Dragline buckets for all types of work • Capacities $\frac{1}{8}$ to 15 cubic yards

There's a reason why more Page Dragline Buckets are used than any other make. By their yardage records on all types of work, Page Buckets have established a reputation of being able to outdig other buckets of equal size and weight. Get the greatest yardage possible from your dragline machine — dig with a Page Automatic Bucket! See your equipment dealer or write us for more information.

PAGE ENGINEERING COMPANY

Page Automatic Dragline Buckets • Page Walking Dragline Machines
CLEARING POST OFFICE, CHICAGO, ILLINOIS

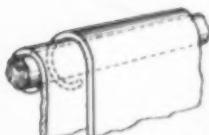
Lightens THE LOAD



FOR concrete work, Sterling Models S-17, S-18 and S-19 are selected by leading Contractors because of these outstanding features:

Perfect Balance 10-Spoke Wheels
Self-Lubricating Bearings
Welded Trays Heavy Tray Load
Malleable Wheel Guards
Channel Steel Legs
Square-Bent Leg Shoes
Hard Maple Handles Interchangeable Parts
Malleable Iron Wheel Brackets

Capacities 3, 3½ and 4 cu. ft. struck.
Complete stocks available from Warehouses
and Distributors in principal cities.



An Exclusive Sterling Feature
Where tray sheets lap, both thicknesses are folded over the continuous butt-welded reinforcing rod, thus giving additional rigidity and strength.

**STERLING WHEELBARROW
COMPANY**

MILWAUKEE, WISCONSIN

MOST OF THE LOAD
IS CARRIED ON THE WHEEL

Sterling Models S-17, S-18 and S-19 are also used for general purpose work, handling sand, gravel, brick, etc. In this service, they have a maximum capacity of 4, 4½ and 5 cubic feet, respectively.

(Continued from page 79)

ment is of great value not only to the farmers who have already had electric service provided for them, but also to those further out on new frontiers. These farms could not have been served feasibly on the basis of the high costs formerly associated with rural line construction but can now be reached on a self-liquidating basis. Furthermore, having gained proficiency in building rural lines by working for REA borrowers, some contractors have now convinced public utility companies of the desirability of constructing their own lines under contract with conditions similar to those existing on REA projects. It has been reported that several companies have now adopted the policy of awarding contracts for line building to independent contractors on a competitive bidding basis. In this way, those concerns will profit by the experience gained in the REA program.

Viewed on a nationwide basis, it can well be said that the REA program has had an effect beyond that of providing electric service to rural communities. It has stimulated many types of industry and thus has contributed in many ways to the industrial development of the United States.

SHE-BOLTS MADE AT

Two-per-Minute
Rate

(Continued from page 65)

presses, a Landis double-headed, bolt-threading machine and a Rehnberg-Jacobsen Mfg. Co., Model 3 automatic tapping machine. One head of the Landis machine has been altered and fitted up to make the taper on the concrete end of the bolt; the other cuts the 1-in. thread with regular Landis dies. These machine tools have been combined and provided with electric- and air-driven equipment to put power drive and automatic control into all operations, resulting in the remarkably high production rate.

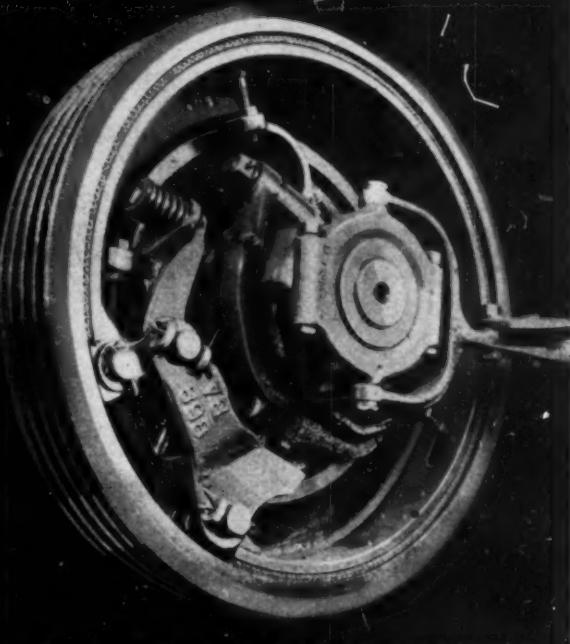
How Bolts Are Made

The five operations are performed in two stages. In the first stage, three operations go on simultaneously, namely, (1) one end of the bolt is drilled longitudinally in preparation for interior threading, (2) the outer surface of this end is trimmed to a taper and (3) a transverse hole is drilled near the opposite end of the rod. The bolt then is slipped over, end for end, into an adjoining location in the machine where a tap at one end and a milling die on the other simultaneously cut inside and outside threads on opposite ends of the rod. Drill speed and advance of the rod in

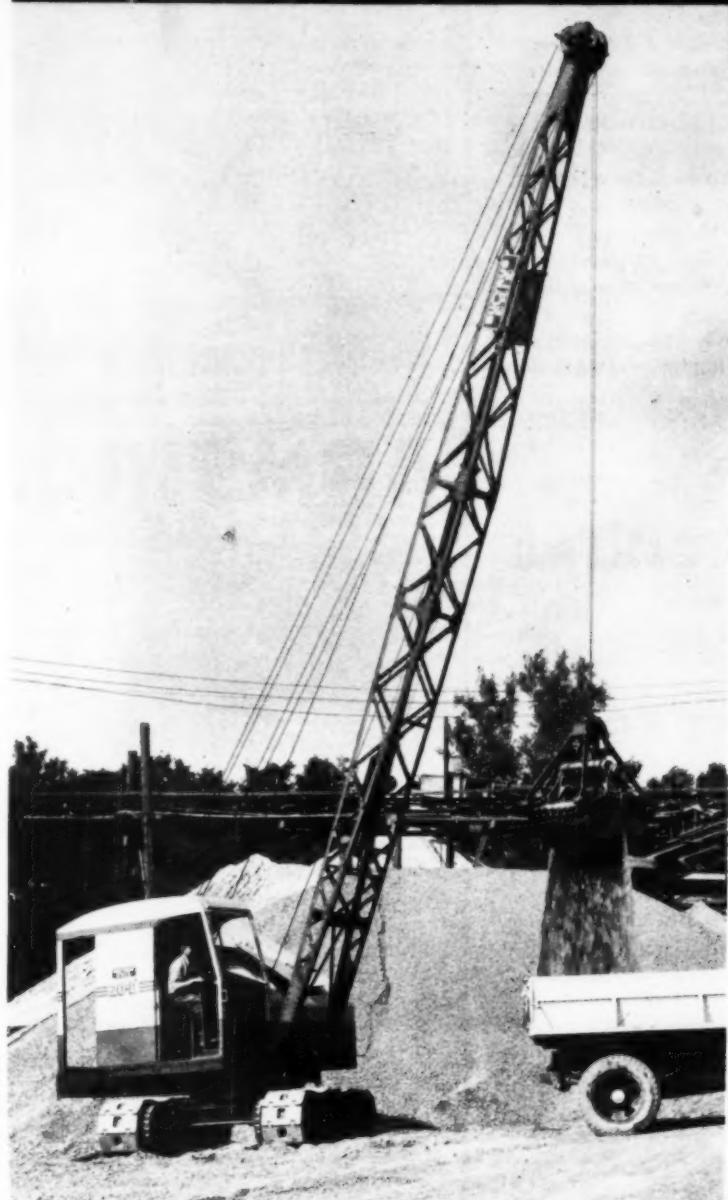
(Continued on page 82)

CRANES

*that handle
with a
smooth, firm grip*



One of four duplicate clutches that give the
3/4-yard 20-B its famous direct-action control.



SPED of operation and accuracy of control on Bucyrus-Erie cranes are, in part, due to the care used in designing the extra large area clutches and brakes so that they take hold uniformly with a smooth firm grip. They keep cool in operation, hold accurate adjustments for long periods. The special linings grip firmly without chattering, and have exceptionally long life.

Provision is made for accurate and convenient adjustment, through a single adjustment unit. Adjustments once made "stay put" on Bucyrus-Erie cranes. The operator always has the feel of the machine and the sure confidence in the clutch and brake action that permits fast, steady operation of the machine at all times.

We believe any shovel, dragline, or crane operator familiar with our modern designs will tell you that Bucyrus-Erie has the smoothest, easiest operating, most dependable clutch and brake system offered by any manufacturer in this field. Find out about the savings fast-moving Bucyrus-Eries offer in your material handling.

Bucyrus-Erie

SOUTH MILWAUKEE, WISCONSIN

*Equipped
for Speed*
READY TO MEET TIME
REQUIREMENTS—

ALL SET FOR THOSE

NATIONAL DEFENSE

CONSTRUCTION JOBS

SUPER-VULCAN
OPEN TYPE
DIFFERENTIAL-ACTING
PILE HAMMERS
18C, 30C, 50C and 80C

Rugged strength—twice the blows per minute—more piles per dollar—simple design—positive action—less steam used—ease of operation—less cost to operate—durability—fit the same leads



Sizes
18C-30C
50C-80C
meet all needs

and use the same accessories as the Vulcan Single-Acting Pile Hammers—compactness... add up all these points and you have the answer for fast, sure, low-cost pile driving with Super-Vulcan Open Type, Differential-Acting Pile Hammers—many users from coast to coast know their great value—write and get all the facts—be prepared with the Super-Vulcan.

VULCAN IRON WORKS
Since 1852

331 North Bell Avenue

Chicago



Illinois

(Continued from page 80.)

the threading operations are controlled by air pressure of 100 lb. per square inch. Power for withdrawal and kick-out comes from the same source but by partially closing valves in the branches of the air line serving these operations, the shock is cushioned and the desired smoothness of operation is obtained without losing the snap of automatic air-trigger releases.

Ordinarily, a two-man crew operates the machine. One man feeds in the raw material, watches oil application on the cutting operations and adjusts controls as necessary. The second man takes each finished she-bolt, starts a nut on the external thread by hand and then thrusts the nut against a motor-driven socket (with tapered sides) until the nut is turned up to about mid-position on the threads.

Metal Racks for Storage

The she-bolts are made from 1-in. bolt steel bought in 20-ft. lengths from each of which can be cut 11 pieces 21 1/4 in. long. As these pieces are cut, they are stacked in metal racks which hold about 400 pieces each. One of these racks is at the left in the accompanying picture. These racks, which have a quick detachable top, are delivered by the overhead crane to a convenient location beside the she-bolt machine. Here the top is removed to facilitate access for rapid feeding.

The contract for Shasta Dam is held by Pacific Constructors, Inc., whose staff devised and constructed the machine.

* * *

CONCRETE LINING Pumped INTO CHICAGO SUBWAY

(Continued from page 51)

southeast on Clybourn to Division St., east on Division to State St. and south on State to Oak St. Construction was started on the shaft in February, 1939.

The Boyle organization established the enviable record of 25 ft. of finished tunnel per working day per heading on straight tube section (average) and but slightly less on station sections and curves. Peak progress of 32.5 ft. each 24-hr. period per heading was reached and maintained on the straight tubes.

Concrete Placing Operations

On the drift tunnel and first few pours in the main tube concrete was placed with a 3/4-yd. pneumatic gun. This unit was replaced with a double-cylinder, gas-powered, concrete pump and 8-in. pipe line, which has a pumping capacity up to 65 cu.yd. per hour and a placing range well in

DRILLS CONCRETE

Like a  HOT KNIFE
through BUTTER!



SAVE 50%-75%
DRILLING TIME!

You'll be frankly amazed at the speed with which you can now drill holes in concrete, hard face brick, tile, porcelain, etc. No more long hours of back-breaking hand chiseling! No more interruptions due to rapid dulling drills!

Carboloy Masonry Drill-Points contain special metal many times harder than hardest steel, stay sharp for hours of continuous use, won't splinter fragile work, drill clean, accurate holes for expansion anchors, and operate quieter for office work. No special equipment needed—use in any rotary drill.

Send coupon for free leaflet.

CARBOLOY COMPANY, INC.
DETROIT, MICHIGAN

Carboloy Co., Inc.
11125 E. 8 Mile Rd., Detroit

Send free leaflet on Carboloy Masonry Drill-Points, for drilling concrete 75% faster.

Name _____

Company _____

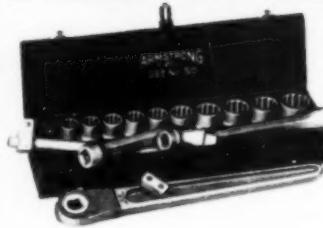
Street _____

City _____ State _____

CARBOLOY MASONRY DRILL-POINTS

ARMSTRONG

WRENCHES



- open end
- Box Socket
- Detachable Socket
- Construction Ratchets

There are ARMSTRONG Wrenches for your every need and each is the finest tool of its type.

ARMSTRONG Socket Wrenches extensions and handles are Chrome-Vanadium Steel. Ratchets are drop forged steel and the patented ARMSTRONG Driveloock locks sockets, driver, ratchets and handles to each

other—will not knock or pry apart, sockets can not fall off.

ARMSTRONG Giant Construction Ratchets are drop forged steel. Nut sockets are machined from solid bar stock.

ARMSTRONG Drop Forged

Structural and Construction Wrenches come in several types, in high carbon or Chrome-Vanadium steel. Large stub end box socket wrench takes long slip over handles.

Write for Catalog



ARMSTRONG BROS. TOOL CO.

"The Tool Holder People"
334 N. Francisco Ave.
Chicago, U.S.A.

Eastern Warehouse & Sales:
199 Lafayette St., New York



★ A GOODALL
Standard of Quality
Reg. U. S. Pat. Office
PRODUCT

"SUBWAY"



AIR HOSE

On Air Spades
Concrete Breakers
Rock Drills
Compressors
Air Hammers

Goodall "Subway" Air Hose has established a reputation over years of trouble-free service to contractors.

Balanced-Built Construction is the reason. All members of the hose (tube, cord, friction and cover) are equalized to give uniform wear. You never have to throw two-thirds of a Goodall "Standard of Quality" hose away because one-third reached its maximum of service and failed.

All that hose you see in the above photo is Goodall "Subway". This contractor takes "Subway" on every job and when he orders more, it's always that "good red air hose of Goodall's".

GOODALL RUBBER CO., INC.
Philadelphia • New York • Boston
Pittsburgh • Chicago

GOODALL
MECHANICAL RUBBER
INC.
FACTORY, TRENTON, N. J.—EST. 1873
DISTRIBUTION POINTS FROM COAST
TO COAST

excess of 1,000 lin.ft. The pump was set on vacant property along the right-of-way and discharged down slanting drop pipes into the tunnel. The drop pipes were spaced at 500 to 900 ft. intervals, depending on available lots and accessibility for batch trucks. On occasions, the pump was set up as far as 150 ft. away from the tunnel line. Although pipe lines up to 1,450 lin.ft. in length, including as many as six 90-deg. ells, were unavoidable at times, approximately 900 ft. was set as about the maximum pumping distance for top efficiency. Two machines were required for the job. At times each unit would be employed on individual headings. On other occasions one pump would handle both headings by means of pipe-line cross-overs between tubes while the other was used on appurtenant structures and pickup work.

Concrete was mixed in two 1½-yd. mixers set up under batching bins in a material yard and wet-batched in dump-trucks to the pump hopper. The distance batched varied from 1 to 2 mi. and 3 yd. of mixed concrete were hauled per trip. This system of transporting concrete has been employed on a number of occasions and is greatly facilitated by the reconditioning efficiency of a pugmill remixer hopper which is standard equipment on the Pumpcrete. The normal 3-yd. capacity of the hopper was extended to 5-yd. both to permit dumping the trucks straight out and to promote further mixing action. The maximum haul is, of course, regulated by the time element between mixing and final placement in the forms.

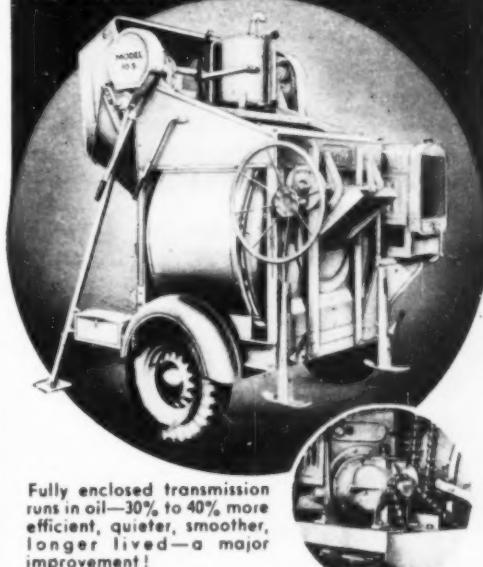
When not in use, the pipe line leading into the tunnel is capped at both ends as a precaution against loss of air. The top of a milk can, inserted into the pipe and held in place by inside pressure serves admirably as a cap for the tunnel end of the line. In starting a pour the bottom cap is left in place until air compression, by displacement in the pipe line, overcomes the tunnel pressure and then it pops out automatically. With 15 lb. of compressed air inside the tunnel, pressure equalizes when the pipe is approximately half full. A small bleeder valve tapped into the top elbow of the riser pipe is left open as a point of escape for displaced air until dropping concrete fills the pipe. Starting and stopping signals are relayed from the heading to the pump operator over a two-point contact line with colored light bulbs at either end and a howler on top. A direct telephone hookup is used for more lengthy communications. At the end of a pour the pipeline is blown out by forcing a "go-devil" behind the concrete with compressed air on lines up to 600 or 700 ft. in length. Longer lines are pumped out with water from the Pumpcrete. The water is blown back to the surface on down grade headings where it would be a nuisance in the hole.

Drop Pipes

A novel and economical arrangement is employed in the installation of sloping drop pipes. A point of entrance is selected

(Continued on page 84)

**MIXERS with
AUTOMOTIVE TYPE
TRANSMISSION**
and MACHINED STEEL DRUM TRACKS



Fully enclosed transmission runs in oil—30% to 40% more efficient, quieter, smoother, longer lived—a major improvement!

... Built by JAEGER
to Mix Faster, Trail and
Handle Easier, Last Longer

These latest SPEEDLINE Mixers—in 3½S to 56S sizes—have all the features that made Jaeger the world's biggest selling mixers, plus sensational improvements never before offered—AUTOMOTIVE-TYPE TRANSMISSION, 100% BALL BEARING SHAFTS, MACHINED ALLOY STEEL GEARS... plus MACHINED, HIGH CARBON STEEL DRUM TRACKS, ON CHILLED, GROUND, CAR-WHEEL ROLLERS... plus oversize engines and vital parts.

Here are the huskiest, smoothest running mixers ever built—combining real heavy duty service with easy handling, end discharge trailer design, 2 or 4-wheel mountings interchangeable. Get our new Catalog and prices and compare.

THE JAEGER MACHINE CO.
800 Dublin Avenue, Columbus, Ohio



JAEGER SPEEDLINE

"FAR AHEAD OF BUCKETS WE HAVE USED IN THE PAST"

• M. F. Quill & Son, Cincinnati, Ohio, are using a Williams $\frac{1}{4}$ Yard Multiple Rope Bucket for excavating and material handling. They write: "We are extremely well satisfied with the performance of this bucket and much impressed with your new welded construction. We feel the design, construction and materials are far ahead of any of the competitive buckets we have used in the past."



You, too, will find Williams digging speed and durability a big factor in producing profits.

Tell us the type of service you are interested in and we will send free, individual bulletins giving complete information.

THE WELLMAN ENGINEERING CO.
7017 Central Ave., Cleveland, Ohio



WILLIAMS Buckets
built by WELLMAN

*With These Jacks
You Hold a Winning Hand!*

Simplex Emergency Jacks will save you time, money and worry in dozens of ways on every construction job. They are far more flexible and useful than ordinary jacks because these not only lift on cap and corrugated toe, but on the auxiliary cap shoe and the chain, any link of which engages in a recess in the cap, besides.

They tilt on their bases for jacking at an angle. Double socket provides for jacking in close quarters.

For those lifting, lowering, pushing and supporting jobs that come up every day, you can't afford to be without Simplex Emergency Jacks.

No. 522, 5-tons, No. 310-A, 15-tons, No. 2030, 20-tons.

Ask your supply house.

TEMPLETON, KENLY & CO., Chicago
Better, Safer Construction Jacks Since 1899



Send for this new catalog. 60 pages of Cost-Cutting, Time-Saving, Job Simplifying Ideas for Contractors and Engineers!



Send for Simplex Catalog 40.

SIMPLEX Jacks
Awarded the Gold Medal for Safety

(Continued from page 83)

on the surface in advance of the heading, the station plus tied in, and a 3- to 4-ft. trench excavated back to the pump's future location. When concreting operations reach this point, a hole is boxed out in the sidewall slightly above the spring line on the same station. The elevation of the two points is determined and the vertical angle (usually around 35 deg.) computed. Ten-foot lengths of heavier casing, with the same inside diameter as the concrete pipe, are lined up and shoved through the clay soil by means of a 50-ton hydraulic jack. The top of the pipe is capped when it reaches the surface and the muck augered out. The entire operation is accomplished in 8 hr. A 2-in. pipe for signal wires is pushed up in the same manner, except for capping the driving end of the smaller pipe to eliminate the job of augering. While it is assumed boulders or radical changes in the soil strata would deflect pipe placed in such a manner off its natural course, remarkable accuracy has been achieved in the present instance; out of a dozen or more attempts none has missed the top excavation to date.

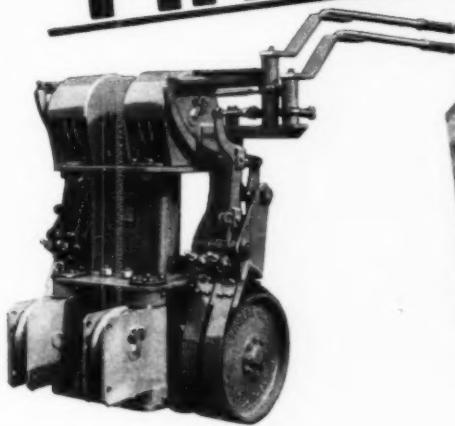
Pumping Invert Concrete

Perhaps the outstanding feature of concreting on this contract was the method of pumping invert concrete immediately behind and during driving operations, thereby gaining the advantage of continuous mining progress on three 8-hr. shifts per day. We are told the idea was developed by the S. A. Healy Co. on similar tunnel construction in Detroit. The operation is effected by holding the lower bench high enough to provide support for a sliding I-beam ramp bridging the section of bottom to be placed. The ramp carries a switch for two stub tracks and is decked over for passageway and to shelter the freshly placed concrete. Climber points on the lower end provide easy ascent for muck cars; empties are pushed up by hand and when loaded roll down by gravity. When the ramp is undercut on the drive to the point where more bearing is desirable, it is pulled forward with an air tucker. Concrete is discharged from the line at a high central point and distributed into the bottom, around and under the ramp, by means of light chutes which are shifted about as occasion demands. Enough clearance is provided to screen and finish the concrete.

Bottom concrete is poured daily in each heading and carried a form-length in advance of the arch, which is poured on a 48-hr. cycle in each heading. Bottom sections of irregular length, up to 35 ft., are poured at any time they are ready for concrete. Thus, an arch may be poured in one tube, the line blown out and connected for a bottom in the opposite tube; then returned to the starting point for the next bottom after a lapse of several hours. This procedure necessitates the maintenance of mixing plant and pumping crews for two shifts, but pays dividends in increased production. The mining foremen

(Continued on page 86)

*Buckeye BLADE DESIGN gives you
"PAYLOAD"*



**BUCKEYE G-L-T
Power Control Units**

HERE'S the Power Control Unit that gives you split-second response and brute strength for the toughest jobs. Built in Medium Duty Models with adaptors for all sizes and makes of tractors, and Heavy Duty Models for big machines — single or double, narrow or wide drums for operating all types of cable-controlled equipment. *Transmits full engine power to line smoothly and evenly without jerking impact.* Write today for full details and description of outstanding features.



"PLUS"

LOOK at the earth piled high above that Buckeye blade — a blade that's higher and longer than the average to start with! You can get a bigger payload in front of a Buckeye Bulldozer or Trailbuilder every time — and your tractor will handle it — because Buckeye's patented blade curvature rolls the dirt ahead with the least power — no "dead" load, no dirt falls back on radiator. It's the same as putting more "horses" in your engine!

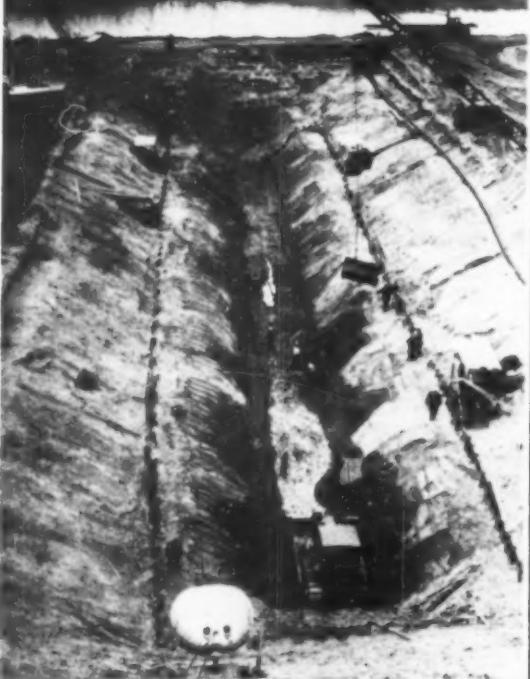
Add to this the natural digging action of The Buckeye cable-controlled blade that creates its own down pressure, the perfect balance that keeps the full length of the crawlers on the ground for greater traction, the rugged, simple, close-coupled construction of the unit and you'll see why these "Western Type" Dozers will give you more yardage per day. Write now for details!

**BUILT
BY Buckeye ✓**

BUCKEYE TRACTION DITCHER COMPANY
FINDLAY — OHIO

DRY AS A BONE

30 FEET BELOW THE PEMIGEWASSET RIVER



East Toe Trench—Franklin Falls Dam, New Hampshire

IN LESS THAN two months, Coleman Bros. Corporation, of Boston, Mass., completed the toe trenches for the \$6,000,000 Franklin Falls Dam in New Hampshire.

From start to finish a **ONE HUNDRED PER CENT MORETRENCH WELL-POINT SYSTEM** kept the water problem out of sight. Your wet job can move along just as fast—and just as economically. Start it right—**IN THE DRY WITH MORETRENCH.**

MORETRENCH CORPORATION

Main Office: 90 West Street, New York
Plant: Rockaway, New Jersey
Branch Warehouses:
Joliet, Illinois and New Orleans, Louisiana

(Continued from page 84)

place the bottom sections with 5 or 6 men who return to their regular duties as muckers and car-pushers as soon as concrete is in place, usually about 2½ hr. The manner of distributing this concrete around and under the ramp bridge from a high discharge point has already been noted.

Placing of Arch

The arch is placed by a regular crew of 8 men and a foreman, who work 40 hr. on a 6-day week; 50 to 64 ft. of form is filled daily, in alternate headings, and follows a fairly rigid schedule. The pour is made with a single line reversing into the center of the form (from a 180-deg. gooseneck) and resting on the top steel. The arch pipe is made up of lightweight, 5-ft. lengths with Victaulic couplings. Sidewalls are filled by shifting the pipe from side to side to keep the form balanced. When the intrados is full to the top of the form, the key is packed by "slugging" concrete into place with intermittent bursts of compressed air delivered from a 2-in. connection and plug-cock valve tapped into the main line on the bottom elbow of the gooseneck. The point of discharge starts from 5 to 8 ft. back of the previous run; as the arch is filled the 5-ft. pipe sections are removed until the bulkhead (full face) is reached. Sidewalls are placed with concrete of approximately 4-in. slump; a lower slump that will stay packed into place is deposited in the keyway. Both external and internal vibration are employed for working sidewall concrete. The arch is vibrated with air hammers just prior to placing the last few slugs. When properly executed, this operation results in a tight, well filled section, almost entirely free of voids and pockets, but care must be exercised not to remove pipe sections too soon, to supply concrete of the proper consistency and to use the vibrator judiciously in the final stages of keying off.

A total of 300 to 350 cu.yd. of concrete are placed daily in the various locations, at an average pumping rate of 45 to 50 yd. per hour, including delays, when pouring is in process. A top capacity of 65 to 68 cu.yd. per hour is reached at times on certain phases of the operation, but as mentioned previously, the nature of the work with a number of pours on a sliding schedule requires the services of two shifts of plant and pumping crews.

Personnel

The subways are being built under the direction of the Chicago Department of Subways and Superhighways, of which Philip Harrington is commissioner, Ralph H. Burke, chief engineer, A. Crain engineer in charge of construction and W. J. MacGregor resident engineer on the sections described above. For the contractor, M. J. Boyle & Co., Harvey Kruse is superintendent.

★

ANOTHER ARTICLE by R. T. Sherrod, describing concrete placement methods and equipment on the Chicago subway contract of Paschen Contractors, Inc., will appear in an early issue. — EDITOR

CUT PLACING COSTS as much as \$45 A DAY

Jaeger "Hoister" and Self-Raising Tower!

Quickly assembled on ground and raised by its 17 H.P. "Hoister"—moves around job on its own skids—handles full ton loads, largest concrete cart or 2 barrows. Standard height 37 ft., add 10 ft. sections up to 67 ft. Saves real money—pays out in no time. Get our price.

JAEGER HOISTS—
6 to 100 H.P. — today's leading line
— advanced features, low prices.
Ask for Catalog H-40.



THE JAEGER MACHINE CO.
800 Dublin Avenue, Columbus, Ohio

MEN—get complete all weather protection with TOWER'S RUBBERIZED (A LATEX PRODUCT) SUITS, COATS and HATS



Look for this famous trade mark.



Tower's waterproof, rubberized work clothing gives dependable, durable performance. Medium weight and designed to give the utmost in freedom of movement and comfort. No cemented seams to pull apart. A choice of styles and full line of sizes to fit every requirement. Unaffected by high or low temperatures.

Also available in oiled type garments if desired.

Sold by all good Dealers or write for folder CM to

A. J. TOWER CO.
BOSTON, MASS.

Makers of Waterproof Clothing Since 1836

**EXACTING
CONDITIONS
GOVERN
Rock Tunnel Driving**

(Continued from page 56)

crete pipe, 54- to 84-in. diameter, at the upper end of the west side diversion sewer, all the diversion sewer structures are monolithic concrete. In open cut, the sewers are reinforced-concrete horseshoe section, 9 ft. 6 in., by 7 ft. 7 $\frac{1}{4}$ in., to 14 ft. 6 in. by 11 ft. 7 $\frac{1}{4}$ in. Tunnel sections are circular, 9 ft. or 12 $\frac{1}{2}$ ft. finished diameter, lined with varying thicknesses of plain concrete; average thickness of the plain concrete lining is 18 in. All monolithic sewer, both open cut and tunnel, has invert paved with vitrified brick. An accompanying sketch shows 12 $\frac{1}{2}$ -ft. tunnel section as built both in typical rock bore and in the special section within 300 ft. each side of the water tunnel, where steel plate lining is required.

Purpose of Sewers

Existing combination sewers in the Rock Creek Valley are equipped at 28 points with outlets which discharge into the stream at times of even light rainfall. Overflows occur as many as 40 times in an average year. Of 183,000 people in the Rock Creek basin, 160,000 within the boundaries of the District of Columbia are served by combined sewers draining into the Rock Creek interceptors. It is the light storms which produce the most frequent overflows, washing the filthiest effluent into the stream. The new diversion sewers will remove all such effluent now entering the stream and will discharge the combined flow into the Potomac River near the mouth of Rock Creek.

For example, upon completion of the east side diversion sewer, no overflow from the combined Piney Branch sewer will enter the creek until the runoff exceeds 1,200 c.f.s. from the Piney Branch area. Similar high rates from other areas downstream will be carried off by the new sewer before any overflow occurs. Overflows from the heaviest storms will be experienced only three or four times per year. When the infrequent heavy storms occur, the first flow from the sewers will wash out the filth into the new sewers. The following overflow will be largely diluted and will come from sewers that are relatively clean, thus constituting no nuisance.

Dry-weather flow in the present system is carried by intercepting sewers to a pumping station which delivers it to a sewage treatment plant in the southernmost part of the District. There the sewage receives treatment before being discharged into the Potomac River below the city. This arrangement will be continued by the new diversion sewers, which include auxiliary structures to return the dry-weather flow

(Continued on page 88)

CORRUGATED STEEL SHEET PILING...

**...CAN BE USED
TO ADVANTAGE
ON ANY OF
THESE JOBS...**

**SEWERS
SEWAGE DISPOSAL
PLANTS
FILTRATION PLANTS
COFFERDAMS
FOUNDATION
EXCAVATIONS
DAMS
LEVEES
BULKHEADS
CUT-OFF WALLS
LOCKS
BRIDGES**

...because

it is light weight for fast, economical handling, yet possesses a tensile strength of about 45,000 lbs. per square inch; can be driven speedily by hand or light power equipment; makes possible a watertight construction; and, in many cases, may be re-used over and over.

Union Metal Corrugated Piling is offered in 8, 10 and 12 gauge in lengths up to 30 ft. Write today for complete product information.



**THE UNION METAL
MANUFACTURING CO.
CANTON, OHIO**

OWEN-EQUIPPED Mobile units BOOST GRAVEL PLANT EFFICIENCY



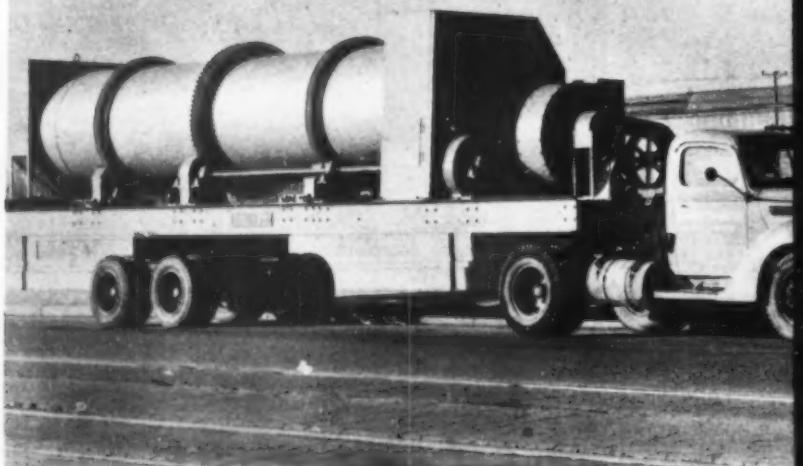
WHETHER it's shuttling up the track to the pile for a capacity grab of dry gravel, or just a matter of swinging the boom and dropping that OWEN into the water pit for a mouthful of dri-

ping aggregate,—one thing is certain; for greatest daily output with minimum operating cost "OWENIZED" mobile units are requisite.

The OWEN BUCKET Co.
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CUT MOVING AND DRYING COSTS



Semi-Trailer Mounting On This Large Capacity Dryer Insures Economical Moving and Set Up Cost Without Investment In Expensive Running Gear

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HEATHERINGTON & BERNER INC.
ENGINEERS AND MANUFACTURERS
701-745 KENTUCKY AVENUE • INDIANAPOLIS, INDIANA

(Continued from page 87)
to the existing interceptors leading to the treatment plant.

Tunnel Driving

As rock tunnel operations on the two Lombardi sections are the most extensive undertaken by any of the contractors, they will be given principal attention here. Rock in the three tunnels driven by this contractor varied widely in formation and in hardness. Mica schist, gneiss and quartzitic rock were encountered, and the formations ranged from seamy (with seams pitched at all angles and in all directions) and blocky to dense, uniform rock that broke clean and shattered well for handling. Seamy and blocky formations caused considerable overbreakage in places. Where timbering was required in bad ground, the contractor used steel sets or steel rings made up of channels or H-beams.

Working Restrictions

Surface operations in Washington ordinarily are restricted to a 12-hr. period between 7 a.m. and 7 p.m. Special permission was obtained by the tunnel contractors to continue surface operations, including the operation of compressors, hoists and trucks, until 10 p.m., making it possible to employ two 7-hr. shifts in the tunnels. Each of the two shifts worked a 40-hr. week, 7 hr. each day from Monday to Friday and 5 hr. on Saturday.

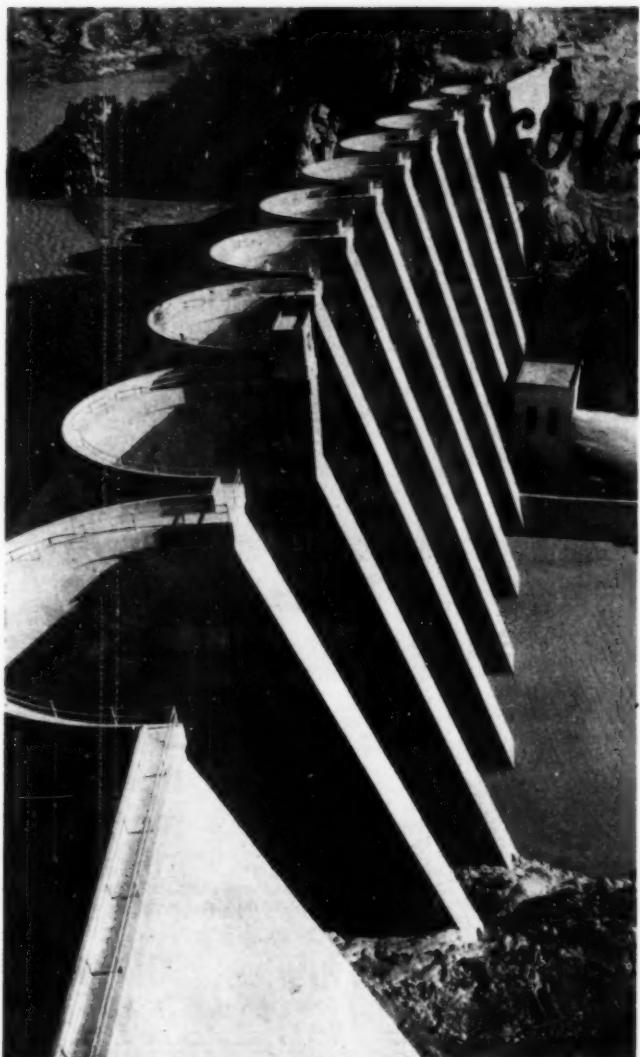
Crossing Water Tunnel

Just 10 ft. of rock and masonry separated the top of the Washington city water supply tunnel, operating under 143-ft. head, from the bottom of the new bore for the east side diversion sewer, making special precautions necessary in excavating the sewer tunnel in the immediate vicinity of the aqueduct. For 50 ft. each side of the vertical plane on the aqueduct center line, original specifications prohibited the use of explosives in removing rock. After attempting by various methods, including use of lime in drilled holes, to remove rock in this section without explosives, the contractor, at the end of 27 shifts, had taken out a total of 5 cu.yd. The rock was a hard mica schist.

Specifications then were modified to permit restricted use of explosives in driving a top heading excavated to the horizontal diameter of the circular section. Depth of drilled holes was limited to 3 ft., and the explosive charge was restricted to an amount consistent with the depth of the holes and the character of the rock. A pilot hole was drilled 12 ft. in advance of the face as a check on water seams or abrupt changes in the rock formation.

To assure a clean break along the horizontal diameter of the tunnel, and to reduce transmission of pressure waves downward toward the water tunnel, the rock face was line-drilled and broached along the bottom to a depth of 3 ft. At the actual crossing of the water tunnel this plane of drilling and broaching on the horizontal diameter was a minimum distance of 18 ft. above the aqueduct.

As the top heading approached the water
(Continued on page 90)



GOVERNMENT ENGINEERS USE CALCIUM CHLORIDE to speed up construction in cold weather concreting

In all National Defense projects and for general construction, concreting must proceed without interruption throughout the winter months. Accelerated hardening and high early strength are essential to successful cold-weather construction.

Government agencies, architects and contractors know that these properties can be imparted to concrete by specifying and using calcium chloride. For they have found it a valuable ally for more than twenty years.

No other method so economically produces high early strength concrete either with standard Portland or High Early Strength Cements. In addition, calcium chloride gives a more workable mix, permits earlier finishing and removal of forms, and gives substantial cold-weather protection by increasing the rate of hardening.



Among many major government projects in which hundreds of tons of calcium chloride have been used are the Grand Coulee and Bartlett Dams. Top and bottom photos taken at Bartlett, center photo at Grand Coulee, by the U.S. Bureau of Reclamation and reproduced through its courtesy.

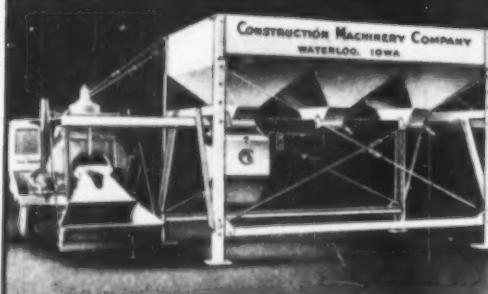
These advantages, apparent in field practice, are fully substantiated by exhaustive test work of the National Bureau of Standards and other impartial authorities in national, state and industrial work.

And with calcium chloride you get speed with safety for the concrete is stronger at all ages, gains safe strength in half the time and, best of all, gives concrete placed at 40° the normal fast setting time of concrete placed at 70°.

If speed is essential in your concreting, always include calcium chloride. Data and specifications are available for the asking.

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ALWAYS AHEAD WITH MONEY-MAKING EQUIPMENT!

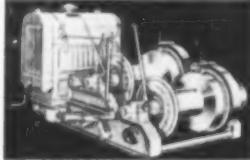


The new CMC Bin Batcher sets a new "high" in profit-making equipment. Takes the advantages of a central mixing plant to every job at remarkably low cost. Used with a CMC 10S or 14S Mixer makes a hard to beat, high producing, cost cutting, concrete producing unit.



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quality. Single
and double
drum up to 40
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See the latest in Mixers, Tilters from $2\frac{1}{2}$ to 10 cu. ft. Non-tilts up to 1 yard. 1 and 2 bag hoe type. Bin batchers, Pumps, Hoists, Power Saws, Carts and Barrows.

CONSTRUCTION MACHINERY COMPANY
WATERLOO, IOWA

(Continued from page 88)

tunnel, the depth of the blast holes was reduced to 2 ft. A sketch reproduced with these notes shows a drilling and blasting round in the top heading when the face had advanced to a point just 2 ft. from the center line of the water tunnel. Across the horizontal diameter, 53 line holes 3 ft. deep were drilled and broached. To pull the face the heading crew drilled 48 blast holes 2 ft. deep which were loaded and fired in two operations, the first breaking out an inner cut and the second blasting the remaining rock to the periphery of the tunnel. Holes were lightly loaded with one to two sticks of 40 per cent gelatin dynamite and each round was fired with ten delays. The maximum charge exploded on one delay was four sticks.

Three air-feed drifter drills were mounted on a horizontal bar to drill the line of bottom holes and to operate the broaching bars. For blast hole drilling, the drills were mounted on columns. After a blast, the broken rock was loaded by hand into wheelbarrows to be moved back to the



TO REDUCE AIR CONCUSSION causing complaints from surrounding residents, concrete bulkhead equipped with heavy timber door is constructed at tunnel portal. Door is closed when blasts are fired.

end of the bench. No removal of the bench was attempted until the entire 100 ft. of top heading had been completed.

Operating two shifts a day under these rigid provisions in the top heading, the crews advanced the face an average distance of slightly better than 2 ft. each working day, completing a full cycle of mucking, drilling, broaching and blasting during the two shifts. Following completion of the top heading, the bench was removed by vertical drilling and hand methods, without use of explosives.

Portals and Shaft

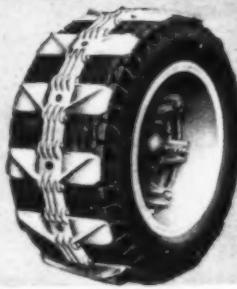
Of the three tunnels excavated by the Lombardi organization, the two shorter bores (a tunnel 1,980 ft. long for a 9-ft. inside diameter sewer and a 1,564-ft. tunnel for a sewer of $12\frac{1}{2}$ -ft. inside diameter) were each driven from a portal at one end. The longest tunnel, with a finished diameter of $12\frac{1}{2}$ ft. and a length of 4,163 ft.,

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WARCO J & S TRACTION
TREADS WILL PLOW THROUGH



In ice, snow, sand, loose ground or mud, your trucks will come through with a pay load if equipped with J & S Traction Treads.



Shoes bridge space between dual tires, forming a large bearing area in contact with ground, producing positive traction, limited only by the power of your engine.

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ACTUAL DOLLARS—COLD CASH—

is represented in each of these sacks, and so in your lumber, your bricks, your tile, your hardware. Profits quickly slide to the other side of the ledger if these materials are not safeguarded.

INSIST ON



WATERPROOFED TARPAULINS

H. WENZEL TENT & DUCK CO.
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was driven from a portal at the north end and a shaft near the south end, headings being turned in two directions from the shaft. This tunnel's north portal and the adjacent south portal of the other 12½-ft. sewer bore are only 1,600 ft. apart, and a central compressor station served the adjacent headings in both tunnels. This station was equipped with two Chicago Pneumatic two-stage compressors, a 1,350-c.f.m. unit driven by a 225-hp. electric motor, and a 1,100-c.f.m. compressor powered by a 200-hp. diesel engine; both compressors were hooked up to a 2,000-cu.ft. receiver. From the receiver, air was delivered to the face at 100-lb. pressure through 4-in. line.

At the two other tunnel headings, high-pressure air was supplied (1) by another Chicago Pneumatic diesel-powered 1,100-c.f.m. compressor for the 9-ft. tunnel, and (2) by an electric-motor-driven Ingersoll-Rand 1,300-c.f.m. unit, set up at the shaft of the long 12½-ft. tunnel. Low-pressure air for ventilation was furnished in all headings by 5,000-c.f.m. blowers driven by 25-hp. electric motors. The air was carried to the headings through 12-in. spiral corrugated steel pipe.

Electric power for the entire job was purchased at 2,200 volts and was stepped down to 220 volts for the motors driving compressors, blowers, mucking machines and auxiliary units. Electric power consumption amounted to about 32,000 kw.-hr. per month. For lighting, the contractor bought power at 110 volts.

Drilling and Mucking

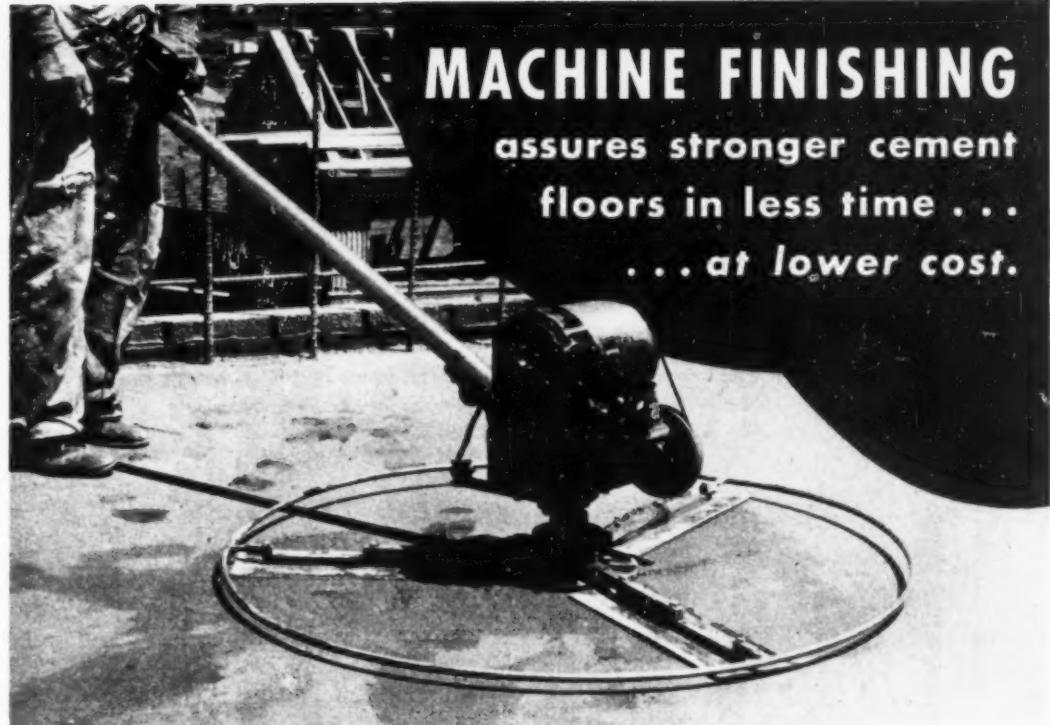
All four headings of the three tunnels employed similar drilling and mucking equipment. Steel jumbos were used for full-face drilling with from three to six drills. A total of 24 Worthington 180 pneumatic-feed wet drifter drills having a 3½-in. bore were operated on the job. The drills accommodated a 30-in. steel change. Timken detachable bits were used for all drilling, and the contractor drilled 11-ft. holes wherever the rock permitted.

In the 12½-ft.-diameter sewer tunnels an average round consisted of 47 holes. The explosive charge ranged from 310 to 486 sticks of duPont 40 per cent and 60 per cent gelatin dynamite; average charges did not exceed 366 sticks. The powder factor ranged from 4 to 5 lb. per cu.yd. An accompanying sketch of an actual drilling and blasting round shows 42 11-ft. holes loaded with 410 sticks, fired in eight delays.

In each heading, muck was loaded by a Conway 50-hp. electric mucking machine. Eight Whitcomb 8-ton storage battery locomotives were distributed among the four headings. The job was equipped with twelve battery sets to allow charging of four while the other eight were in use. Mucking machines and haulage equipment operated on 36-in. gage track.

Steel headframes and hoisting equipment were installed at the shaft and at one of the portals to handle muck, and blasted rock was delivered to the hoist skips at these two points by Koppel 6-cu.yd. side-dump cars. At the other two portals, muck was hauled outside the tunnels

(Continued on page 92)



MACHINE FINISHING assures stronger cement floors in less time at lower cost.

- You get a far denser, more wear-resistant cement floor with the "Whiteman" Precision Cement Floor Finisher—a floor without laitance or voids caused by water or air particles. The rotating steel trowels produce an absolutely level floor without high or low spots or ripples, and with the coarse aggregate uniformly distributed right up to the wearing surface.

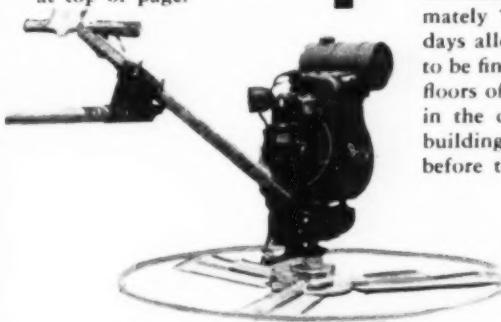
You can cover 1,000 sq. ft. in as little as 15 minutes with the "Whiteman" finisher, the only machine that completely FLOATS and STEEL TROWELS a cement floor. It glides over the surface under absolute control of the operator—and produces flatter, smoother floors in half the time.

On any job—particularly on Defense Projects where high speed is required—you can finish cement with the "Whiteman" finisher at substantially reduced cost. It eliminates unnecessary costly overtime, and is real insurance against having your floor "get away from you" when extra finishers are not available.

The "Whiteman" machine has given successful performance everywhere, being used on work for the Douglas Aircraft Corp., Santa Monica; Lockheed Aircraft Corp., Burbank; Alameda Naval Base, Alameda, Calif.; and many other jobs.

Write or Wire Collect TODAY for the name of your nearest dealer.

The "Whiteman" Precision Cement Floor Finisher will cover 1,000 sq. ft. in as little as 15 minutes. Gasoline model is shown below. Electric model is pictured at top of page.



SPEEDS WORK ON HOUSING PROJECT

Contractors handling a western housing project of approximately 750 family units—a "hurry up" job with only 400 days allowed from "notice to proceed" until the work had to be finished—used the "Whiteman" Finisher on the second floors of all buildings. Work on the second floor was done in the open air exposed to sun and weather. The entire building area (averaging 27 x 150 ft.) had to be finished before the concrete took its initial set. The power driven rotating trowels of the "Whiteman" finisher did the job—and improved the quality of the concrete. The Finisher made special protection unnecessary as the surface was entirely finished before protection was required.

**"WHITEMAN"
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finisher**

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PONY

Solid Shank

FEATHERWEIGHT

Shovels

PERFECT BALANCE

A new redesigned socket gives to the PONY Solid Shank Shovel the perfect balance which no other solid shank shovel has.

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The famous ABW Shock Band gives to the shovel greater handle strength. This is a patented feature of PONY Solid Shank Shovels.

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ABW PRODUCTS

SHOVELS FORKS
SPADES HOES
SCOOPS RAKES
POST HOLE DIGGERS
AGRICULTURAL HANDLES

(Continued from page 91)
in skips on flat cars, and cranes handled the skiploads of rock into trucks.

Blasting Bulkheads

When blasting operations started in the tunnels, numerous complaints were received from nearby residents. Adjacent portals of the two 12½-ft.-diameter sewer tunnels are close to concrete arch bridges spanning Rock Creek Valley, and investigation disclosed that these bridges acted as sounding boards, redoubling the effect of air concussion. By erecting concrete tunnel bulkheads equipped with heavy timber doors which were closed when a blast was being made, the contractor stopped the rattling of windows in the neighborhood and reduced the number of complaints 75 to 95 per cent.

Progress

In each of the 12½-ft. hard rock headings, the tunnel crews completed a full cycle of mucking, drilling and blasting in two shifts and made average progress of 50 to 60 ft. per 80-hr. week. Bad rock conditions caused slower progress in the 9-ft. tunnel, where the crews advanced the heading from 8 to 45 ft. in an 80-hr. work week and averaged about 30 ft. per week.

Tunnel Lining

After completing the concrete invert of the tunnels, the contractor planned to place the arch lining with Ransome pneumatic guns delivering to Blaw-Knox steel forms coupled in 60-ft. units.

West Side Tunnel

Methods employed for drilling and mucking in Stiers Bros. 9-ft. tunnel on the west side of the valley were in general similar to those already described. Muck was moved out of the tunnel by man power in 2-yd. rollover dump cars. At the portal the cars were pulled up an incline by a power hoist to dump into an overhead bin which discharged into trucks in a depressed roadway. Sections of bad ground were supported by I-section steel rings. Progress in the tunnel ranged from about 50 to 80 ft. per 80-hr. week and averaged about 65 ft.

Open-Cut Construction

For trenches up to 40 ft. deep, the Lombardi organization drove steel H-columns in advance of excavation and installed horizontal timber sheeting as earth was removed from between the trench walls. The trench was cross-braced with 12 x12-in. timbers. In shallower trenches, all the contractors employed vertical sheeting with timber wales and braces.

Administration

For the Board of Commissioners of the District of Columbia, J. B. Gordon is director of sanitary engineering, in charge of the Department of Sanitary Engineering, of which H. A. Kemp is chief engineer on PWA sewer projects. Construction of the Rock Creek sewers is under the direction of Ellwood Johnson, resident engineer, who also is superintendent of the District sewage treatment plant.

Metcalf & Eddy, consulting engineers,

(Continued on page 94)

Beat construction problems before they occur . . .

with efficient planning of work and plant as shown in this new book

Here's a truly money-making volume for contractors, engineers, and others concerned with heavy construction projects — giving you all the essentials of planning the camp, plant, and working schedules to attain the smoothest, most economical, and most productive operation. Largely with specific facts right from the authors' experience on the Tennessee Valley dams, the book shows the vital points to consider in planning the job plant and its operations, and includes many descriptions and data on construction machinery to aid in all the problems of selection and operation.

Just Out!

CONSTRUCTION PLANNING AND PLANT

By ADOLPH J. ACKERMAN
Director of Engineering, the Dravo Corporation Branch,
Neville Island

and CHARLES H. LOCHER
Contractor

381 pages, 6 x 9, 156 illustrations, \$4.00

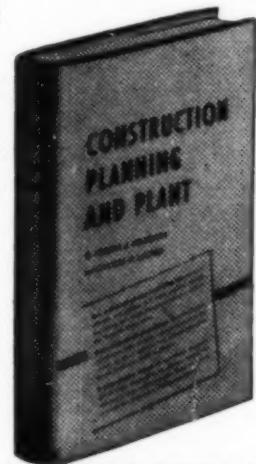
THE treatment throughout is for practical construction men. The facts and examples are all from typical heavy construction experience. For the first time performance data is assembled for convenient reference on various sizes and types of equipment, including actual experience of production on jobs. So comprehensive and practical is this material that you will get many valuable tips on construction methods from it as well as aid in the selection of equipment.

Many Valuable Tables

The book is generously interspersed with tables which show camp facilities; shop and yard facilities; cost analysis in loading and hauling earth; specifications of large Diesel track-type tractors; standard rock crushers; car-unloading methods; variables which affect output of excavating equipment; etc., etc.

A few of the 250 major topics treated:

Models of Construction Layout and Equipment
Coordinating Design and Selection of Plant
Dormitories
Financial Schedules
Records Which Help to Keep Equipment Working
Analyzing Daily Operators' Reports
Construction Sequence on Cofferdams
Rules for Pile Driving
Selection of Pumps
Economics of Hauling Equipment
Consolidation on Cementation Processes
Compressed-air Regulations
Drilling and Mucking



SEE IT 10 DAYS • MAIL THE COUPON

McGraw-Hill Book Co., Inc., 330 W. 42nd St., N. Y. C.
Send me Ackerman and Locher's Construction Planning and Plant for 10 days' examination on approval. In 10 days I will send \$4.00 plus few cents postage, or return book postpaid. (We pay postage on orders accompanied by remittance.)

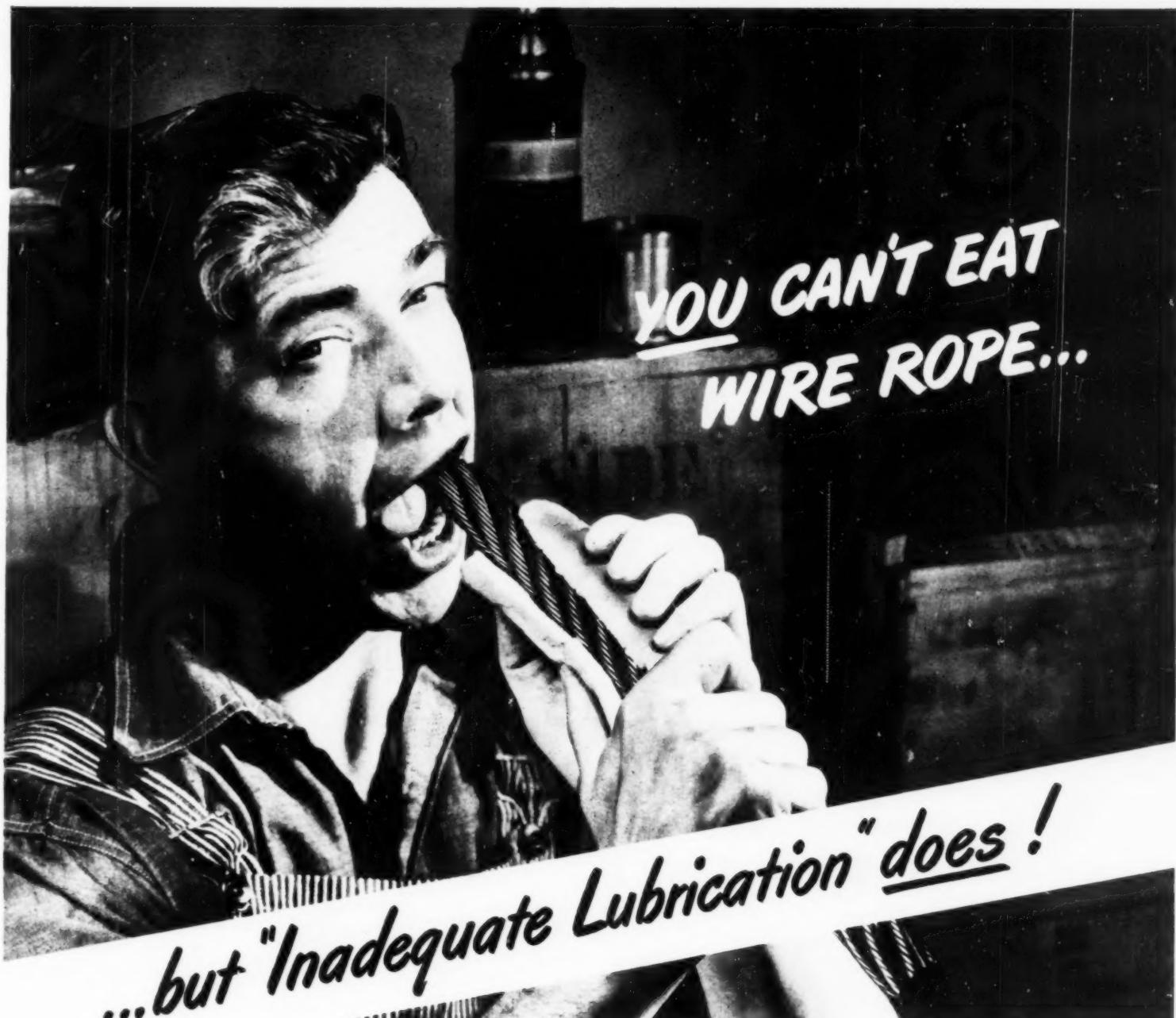
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Company _____ C.M.-12-40
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Perhaps you never thought of lubrication in just this way—but picture to yourself thousands of tiny "bearings" sliding and pressing against each other. Naturally, they must be lubricated—and naturally you'll see that they are lubricated in your wire ropes—when you realize what it means in dollars and cents.

A proper wire rope lubricant regularly applied to the rope on the job, forms a protective coating that

keeps those thousands of "bearings" operating with minimum friction. The result:—Wire fatigue and corrosion checked; more uniform wear; longer rope life.

Be sure your lubricant is the *right* one, that you are applying it properly and with sufficient frequency.

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ROEBLING
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Ask about ROEBLING "BLUE CENTER" WIRE ROPE... either preformed or standard

CORRECT LUBRICATION:

1. Reduces Rope Wear
2. Prevents Corrosion
3. Prolongs Rope Life
4. Lowers Operating Cost
5. Provides Greater Safety

This advertisement is published in the interest of all wire rope users to help them obtain greater safety, service and efficiency from their wire rope.

(Continued from page 92)



A PACE SETTER

A quick get-away at the crack of the starter's gun is the usual thing when SCHRAMM Utility Compressors are on the job.

The guns in this instance being; two heavy-duty Cleveland Paving Breakers tearing up an old asphalt and cobblestone street for the City of Baltimore. The work being done on one of Baltimore's main thoroughfares, leading to the Washington Boulevard.

When we say; "Quick Starter", we mean just that. With a built-in Electric Starter, self-aligning Clutch, quick starting is a "cinch" no matter how close to zero the old thermometer is registering.

Write now for complete information on the SCHRAMM Easy-to-start, Frost-Proof Utility Compressor—Bulletin 3900-D has all the answers.

Schramm, Inc., West Chester, Pa.

Boston, Mass., prepared the plans for the diversion sewers. Neil G. Medbery represents the consultants on the project.

On the contract sections of Joseph Lombardi, Philadelphia, both Joseph Lombardi and his brother, Robert Lombardi, have maintained close contact with the work. Thomas E. Laws, and Phillip Brown, general superintendents, and E. M. Richardson, Joseph Collogi and Dominic Lombardi, superintendents, have been in charge of construction for the contractor. The contract of the Stiers Bros. Construction Co., St. Louis, for the west side diversion sewer, has been carried out under the direction of M. Gollub, engineer in general charge for the contractor.

★ ★ ★

Road-Mix

Machine

PROCESSES STABILIZED SURFACE

(Continued from page 61)

had been adjusted to give the desired plasticity within the grading limits, the contractor mixed for each square yard of stabilized surface 0.1 cu.yd. of graded aggregate and 0.01 cu.yd. of binder clay. An accompanying tabulation gives the specified gradation of the stabilized mixture. From most of the county's gravel banks, aggregate naturally sized within the specification limits could be obtained

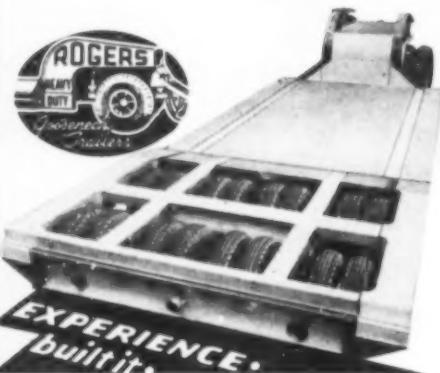
SCHRAMM COMPRESSORS

Haul 10 ft.

LOADS and

Return Quickly

with 8 ft. TRAILER



ROGERS swinging side brackets permit you to haul the occasional extra wide load on a trailer that

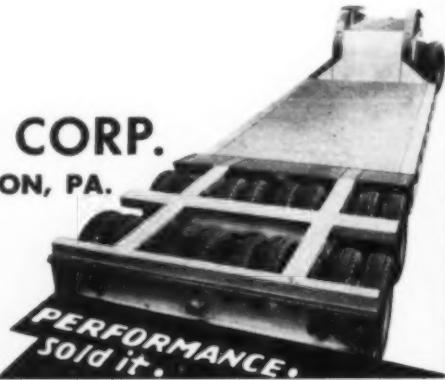
normally complies with legal limits as to width. Trailers with capacities as large as 60 tons are available so equipped.

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Stabilized Mixture
Wayne County, Ohio

SCREEN OR SIEVE	PER CENT PASSING
1-in.	100
3/4-in.	80-100
5/8-in.	50-90
No. 4	40-75
No. 10	30-55
No. 40	20-35
No. 200	10-20

with little labor in removing or crushing larger stone. Of the fraction of the binder material passing the 40 mesh sieve, the plasticity index was required to be between 4 and 12.

Existing Base

Stabilized top course was placed on existing traffic-bound courses, 2 to 5 in. thick, of crushed limestone. Experience in

(Continued on page 96)

Come and get the answers!

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for
DEFENSE

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- A new field for the contractor—the airport!
- Super highways—the big jobs of the future!
- What about new things in Snow and Ice Control?
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- How shall we redesign intersections?
- Why develop the interregional roads?
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- Traffic—how to analyze it!

These subjects are close to your pocketbook—men who have found the answers are going to tell you about them—give you a chance to discuss them—ask questions! Here's the year's opportunity to get real help on the things that are bothering you most. Note the date—plan now to come!

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EXPERIENCES
-FUN!

CONSTRUCTION METHODS

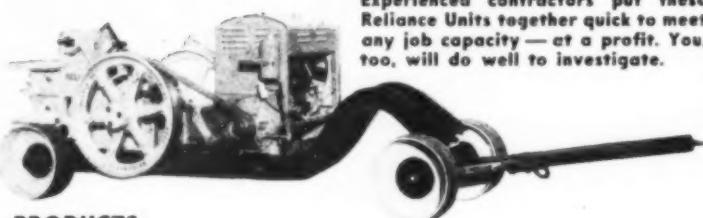
330 West 42nd Street • New York, N.Y.

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PORTABLE with V-BELT DRIVE

Whether you use this Reliance Portable Crusher alone or in combination with an Elevator, Chute Screen, etc., you can get no better value for your money in terms of capacity, low operating cost and rugged durability. The Reliance Crusher is famous for its strength and simplicity. It is particularly stable. A "swell" buy for crushing on any job. Send for detailed circular.



PRODUCTS:

Reliance offers a complete line of Rock Crushers; Bucket Elevators; Revolving Screens; Storage Bins; Pulverizers; Chip Spreaders; Heating Kettles; Bin Gates; Feeders; Belt Conveyors; Grizzlies; Air Separators; Sand and Gravel Spreaders; Wash Boxes.

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A complete unit—rapidly set up, inexpensive to operate, insuring large capacity, very little vibration. Crushing, elevating, washing, screening done on spot, materials stored in Reliance Steel or Wood Bins (completely fabricated, easy to erect). Experienced contractors put these Reliance Units together quick to meet any job capacity—at a profit. You, too, will do well to investigate.

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DISTRIBUTORS in ALL PRINCIPAL CITIES of U. S. A.

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Ransome. has a CONCRETE answer*



PAVERS—34-E "Single and Dual Drum" with many time and money saving features.

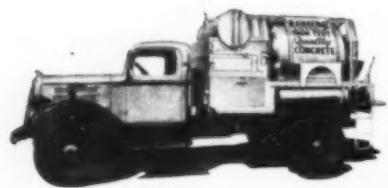


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TRUCK MIXERS—Standard Sizes 2, 3, 4 and 6 cu. yds. with many exclusive features.

AGITATORS—3, 4 1/2, 6 and 7 cu. yds.

and a complete line of concrete handling equipment

Ransome.

CONCRETE MACHINERY COMPANY
DUNELLEN, NEW JERSEY

(Continued from page 94)

bonding the stabilized layer with the traffic-bound limestone base caused modification of the construction procedure as work progressed.

Changes in Procedure

At the start, binder clay first was spread on the traffic-bound limestone, and the gravel and calcium chloride were spread in separate applications on top of the clay, ready for mixing by the road machine. With the intention of assuring a complete bond between the old and the new layers, the mixing teeth of the road machine was set 1/2 in. below surface grade of the traffic-bound limestone. Experience with this procedure revealed two difficulties: (1) incorporating the top 1/2 in. of the existing traffic-bound course caused a lowering of the plasticity index of the final mixture as a result of the fact that traffic had whipped practically all the clay from the interstices of the limestone, leaving practically nothing but fine sand and silt between the stone fragments and (2) the traffic-bound limestone surface proved so dense that it wore out the mixing teeth, making replacement cost prohibitive.

Because of these difficulties, the procedure was changed to permit placing the crusher-run bank gravel next to the existing surface, with the clay and calcium chloride spread in separate applications on top of the gravel, and the mixing teeth were adjusted to the grade of the traffic-bound base. After this change, the mixing teeth no longer cut into the old surface, and only new materials were incorporated in the stabilized mixture.

Methods of Construction

In accordance with the final procedure adopted for construction of stabilized surface, the contractor spread crusher-run gravel with two 9-ft. spreader boxes on traffic-bound base which had been swept clean of all loose material. A Gledhill blade machine shaped the gravel to proper crown and thickness. Over the 18-ft. width of gravel, the contractor spread a uniform application of clay which had been dried and pulverized until not less than 80 per cent passed the No. 4 sieve. As a final application, calcium chloride was placed at the rate of 1 1/2 lb. per square yard on top of the clay.

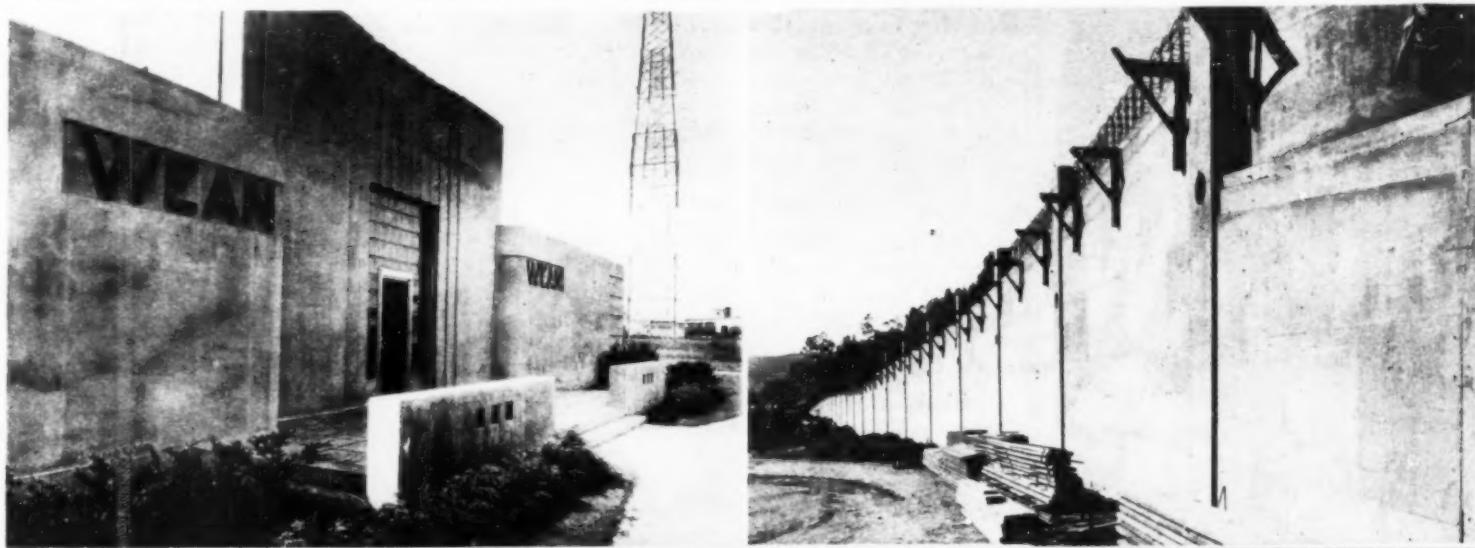
With the three materials spread in successive applications ready for mixing, a Flynn self-propelled road machine made two trips over the section, one side at a time, adding the proper quantity of water, mixing the materials and compacting the completed mixture at optimum moisture content. The machine moved forward on crawler treads at a rate of 600 to 800 ft. per hour, mixing and tamping the stabilized surface as it progressed. For actual mixing, the machine was equipped with a revolving shaft 10 ft. in length on which were mounted four rows of teeth, with fifteen teeth in each row, the rows being spiraled to maintain a uniform torque on the driving motor.

Immediately in front of this revolving mixing element was a set of nozzles which

(Continued on page 98)

• The smooth exterior of the smart, modern WEAN broadcasting station at East Providence, R. I., is the result of the concrete being formed against Plyform. Harry E. Davidson & Son, arch.: A. W. Merchant Co., contr.

• The Hollywood Freeway, a marvelous new highway north out of Los Angeles, is a joint Los Angeles-State of California project. 5/8" Plyform was used to form all retaining walls. Note large area each panel covered.



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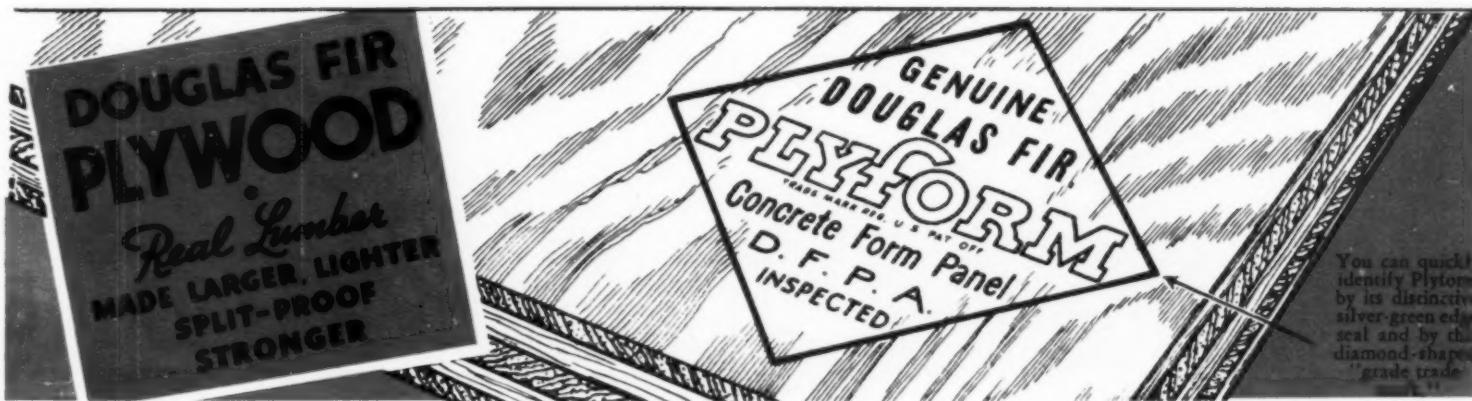
• When specifications call for smooth, flawless exposed concrete surfaces, use Plyform. This is the grade of Douglas Fir Plywood made especially to form superior concrete.

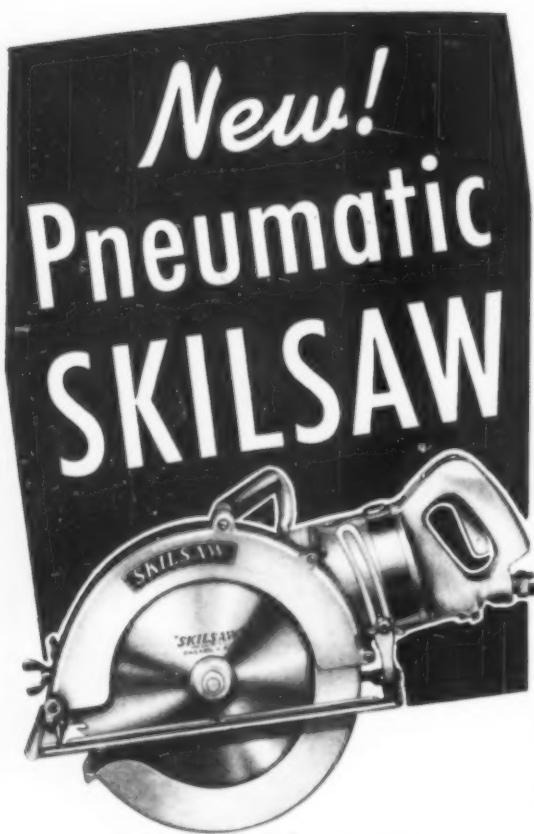
In Plyform, special veneers and special highly water-resistant glues are used. Each panel is sanded satin-smooth, oil-treated, edge-sealed in a distinctive silver-green and stamped with the Plyform "grade trade-mark" to make identification easy. The result is a quality panel that combines light weight, large size and great strength . . . that serves as sheathing and lining combined . . . that works easily . . . that can be nailed without boring. Plyform minimizes joints and fins . . . cuts costs of rubbing from 5 to 12c a foot. When handled with reasonable care, it can be re-used many times, then salvaged for utility purposes.

Be sure to specify Plyform. It costs just over 1c a square foot more than SO2S Plypanel of the same size and thickness. But this small extra investment will repay you many times. For free 12-page concrete form booklet, write Douglas Fir Plywood Association, Tacoma Building, Tacoma, Washington.

For economical performance:

1. After each use, stack Plyform flat on dry, level platforms using stickers to permit normal drying.
2. Long time storage should be indoors. (Tarpaulins may prevent proper air circulation and cause moisture to collect.)
3. Use wooden wedges rather than pinch bars in stripping.
4. Lower carefully from high places. Don't drop on edges or permit careless handling.
5. Clean panels thoroughly after each use.
6. Re-oil before each pouring. A standard wood form oil or pale oil is generally preferred.
7. Don't swab on too much oil—just enough so that the surface feels greasy to touch.
8. All newly cut edges should be sealed or doped with white lead and oil or other effective sealer.





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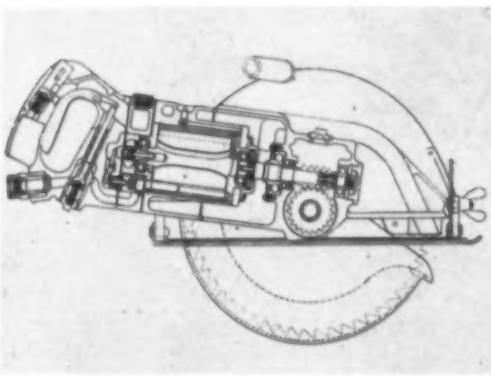
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(Continued from page 96)

added water to the mixture. The nozzles were adjusted and the pressure regulated to supply a measured quantity of water assuring optimum moisture content in the final mixture. A centrifugal pump fed water to the nozzles from a 350-gal. reserve tank which was kept filled by two 1,000-gal. tank trucks.

Tamping Device

At the rear of the machine was a tamping element, consisting of ten tampers operated by an eccentric shaft. Each tamper carried five feet which compacted the mixture by repeated impact, concentrating the tamping pressure in small areas in somewhat the same manner as a sheep's-foot roller. All moving elements of the machine were powered by a single diesel engine which drove the crawler treads, the mixing cylinder, the water pump and the tampers.

For added compaction, the stabilized course was rolled with either a 10-ton three-wheel roller or a 10-ton tandem roller, care being taken not to displace the stabilized mixture if the moisture content happened to be slightly above the optimum in the plastic range. For a while, a 5-ton three-wheel roller was used immediately behind the road-mix machine, but the lighter roller proved unsatisfactory for this service, and its use was discontinued.

Seasoning Period

Following mixing and compaction, the stabilized surface was permitted to season for a period of 5 to 10 days, during which additional wetting and rolling were performed and surface irregularities were corrected. To assure adequate drainage, the stabilized surface and semi-stabilized berms were shaped to a crown of about 1/2 in. per foot across the entire width of roadway.

When the surface and semi-stabilized shoulders had obtained required smoothness and density (usually about 7 days after mixing), a surface application of calcium chloride was added to the 18-ft. traveled way at the rate of 1/2 lb. per square yard by means of a drill type distributor equipped with a spreader board to aid uniform distribution.

Semi-Stabilized Berms

Cleaning the ditches to proper cross section with blade graders turned up a quantity of soil for use in the berms. Sod was picked up from this earth by hand and was hauled from the project. The remainder of the earth was combined with loose aggregate from the existing traffic-bound surface to form the semi-stabilized berms.

Construction Personnel

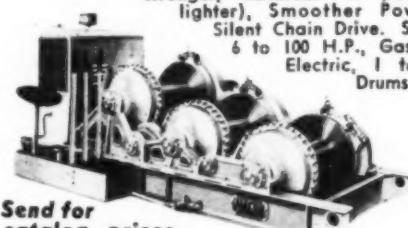
Construction of the stabilized surface and semi-stabilized shoulders was performed by contract for the County Commissioners of Wayne County, Ohio, by the Ohio Engineering Co., Lorain, Ohio, with Ralph O. Perrott as superintendent. Paul E. Glasgow, county engineer, assisted by James E. Rohr, project engineer, supervised the work for the county. A grant to



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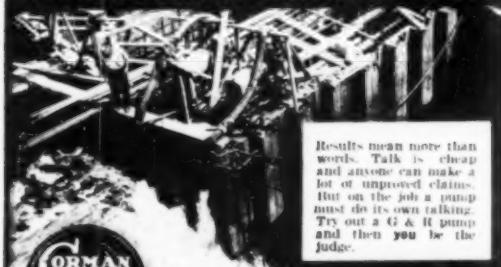
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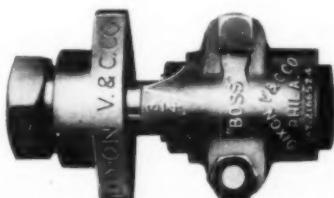
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finance 45 per cent of the cost of the road improvement was provided by the Public Works Administration, and the interests of the Federal Government were represented by S. E. Braswell, associate engineer, Public Roads Administration, and by the writer, acting as engineer-inspector.

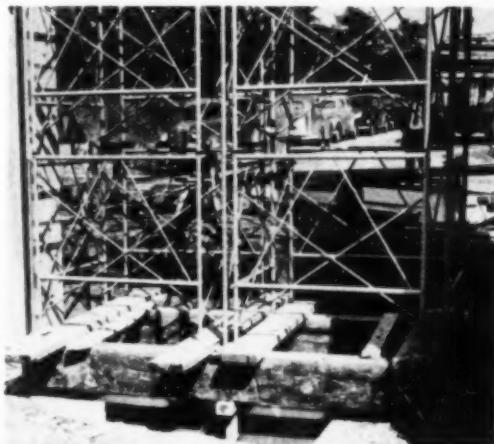
* * *

Sectional Steel Scaffold SERVES AS FALSEWORK

(Continued from page 63)

ed tubular scaffold sections. The units were 5 ft. wide and were employed on this job in two standard heights, 5 ft. and 3 ft., the shorter sections being used to fill out the top of the towers under the end bents, where the total height of scaffolding was 23 ft. Sections were erected, one upon another, by inserting coupling pins in the tubular legs. The legs were equipped with welded stud screws to which crossbraces were attached with wing nuts to complete the tower frame. At the peak of pier construction, with scaffold towers in use at four bents, the contractor had almost 500 frame units on the job.

Because of the simplicity of the scaffold assembly, workmen were able to erect and dismantle the falsework quickly. Two men



HEAVY TIMBER STRINGERS, bridging gap between column footings of abutment bent, support steel scaffold towers.

could set the complete framing for one of the intermediate bents, requiring 40 scaffold units and necessary crossbraces, in 3 hr. The scaffold, by virtue of the large number of working levels which it provided, also aided such operations as form erection, form stripping and concrete rubbing. In removing equipment from the first completed abutment bent to the second similar bent, a crew of four men in 8 hr. stripped the forms, dismantled the scaffold, and re-erected the framing

(Continued on page 100)

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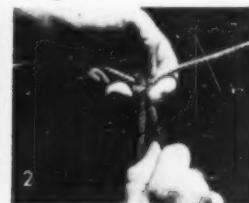
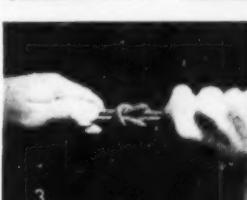
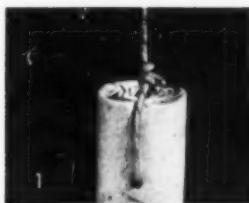
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(Continued from page 99)

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in its new location. This scaffold involved some 70 units, plus the required cross-bracing.

Bridge Spans

Deck structure on the bridge consists of five I-beam spans carrying a 36-ft. concrete roadway and two sidewalks. A 65-ft. center span, two 56-ft. intermediate spans and two 47-ft. end spans make up an overall bridge length of 270 ft.

Pier footings rest on a total of 400 creosoted timber piles. Footings of the four intermediate piers are continuous under the three columns of each bent, but columns of the end bents are carried on individual footings, and 6x12-in. timber stringers set on edge were required to bridge the gaps between these footings and support the scaffold towers.

Concreting Methods

Plywood panels were used to form the concrete footings. For the piers, the contractor had two sets of 2-in. wood panel forms, one set for the two end bents and another set for the four intermediate bents.

Concrete was delivered to the job in truck mixers from a commercial plant and was pumped to the forms through 6-in. pipe line of 450-ft. maximum length by a portable single-chambered Pumpcrete unit. When delivering concrete to a bent, the end of the pipe line was supported on top of the beam form by steel scaffold frames resting on the form wales. The largest monolithic pour was in the west abutment pier, which required 160 cu.yd. for the three columns and beam. This concrete was placed in about 13 hr.

Total volume of concrete for the piers amounted to 770 cu.yd., of which 240 cu.yd. went into the footings. An additional 240 cu.yd. was required for the four intermediate bents, and 130 cu.yd. was placed in the east abutment. The six piers were reinforced with about 50,000 lb. of steel bars.

Progress

Excavation in the bridge site started June 11, and the first foundation pile was driven July 3. The contractor completed driving the 400 piles in 30 days. Concrete was placed in the first footing, for one of the intermediate piers, on July 11, and concreting of the last of the six bents was due for completion September 6. Within the following 4 weeks, the contractor erected the steel I-beams with a stiff-leg derrick, setting the first two spans with the derrick on the ground and then moving the rig up on top to place the remaining spans. The concrete deck was expected to be completed before the end of October, making it possible for the contractor to turn the job over to the state more than two months prior to expiration of the contract time limit of 280 calendar days. Contract value of the work was about \$73,000.

Howard Cain, superintendent, was in charge of the job for the Bentley Construction Co., Milwaukee, of which Thomas H. Bentley is president. For the Wisconsin Highway Department, Paul Powers was project engineer.

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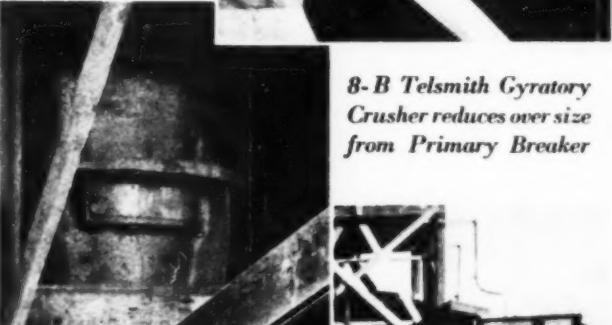
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3rd Cover	
American Chain Division,	78
American Chain & Cable Co.	36
(American Cable Division)	102
3rd Cover	
(American Chain Division)	36
(Hazard Wire Rope Div.)	17
Ames Baldwin Wyoming Co.	92
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Harnischfeger Corp.	35
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Koehring Company, The	27
L & M Mfg. Company	102
La Crosse Trailer & Equip. Co.	74
La Plant-Choate Mfg. Co.	22
Lehigh Portland Cement Co.	23
Leschen & Sons Rope Co., A.	4th Cover
Le Tourneau, Inc., R. G.	14
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Ransome Concrete Machinery Co.	96
Riddell Corp., W. A.	90
Roebling & Sons Co., John A.	93
Rogers Bros. Corp.	94
Schramm, Inc.	94
Searchlight Section	102
Shell Oil Company	26
Sinclair Refining Co.	20
Skilsaw, Inc.	98
Smith Engineering Works	101
Standard Oil Co. of Indiana	37
Sterling Machinery Corp.	25
Sterling Wheelbarrow Co.	80
Syntron Co.	100
Templeton, Kenly & Co.	84
Texas Company, The	10
Thew Shovel Co.	11
Thornton-Tandem Co.	72
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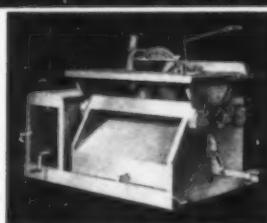
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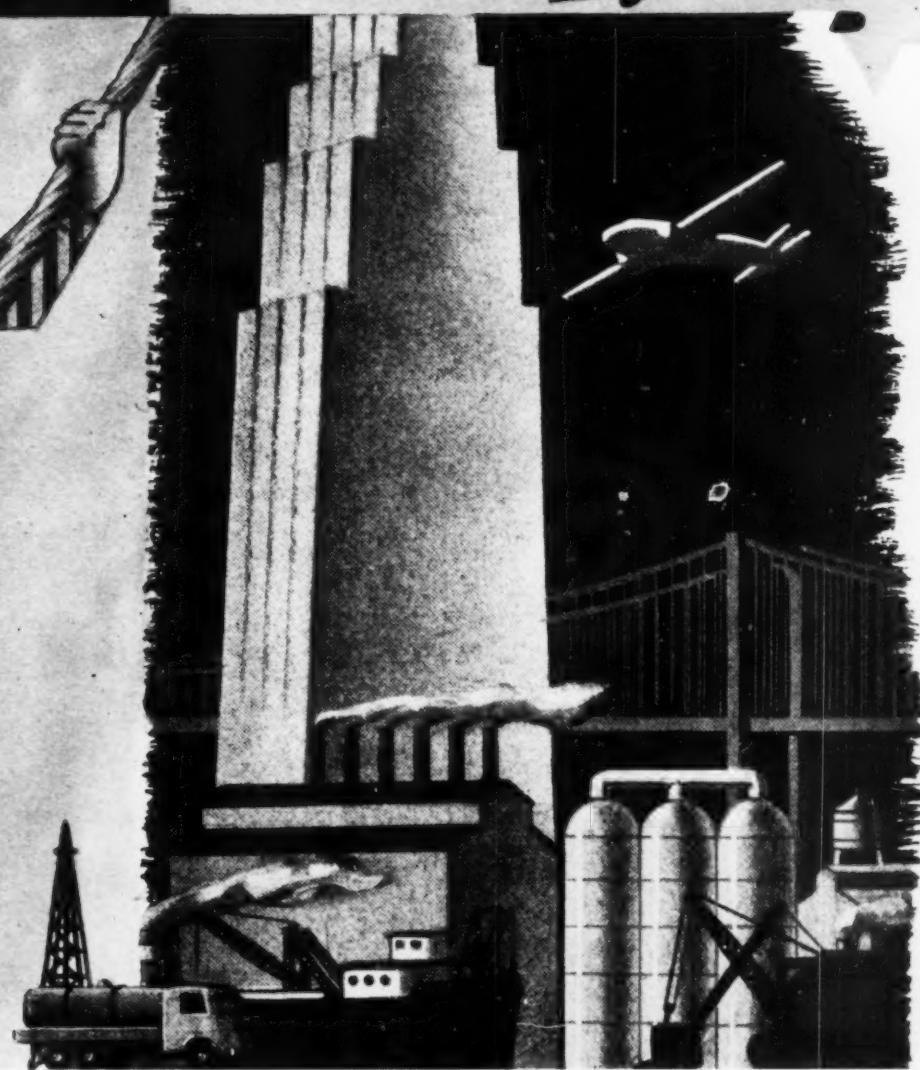
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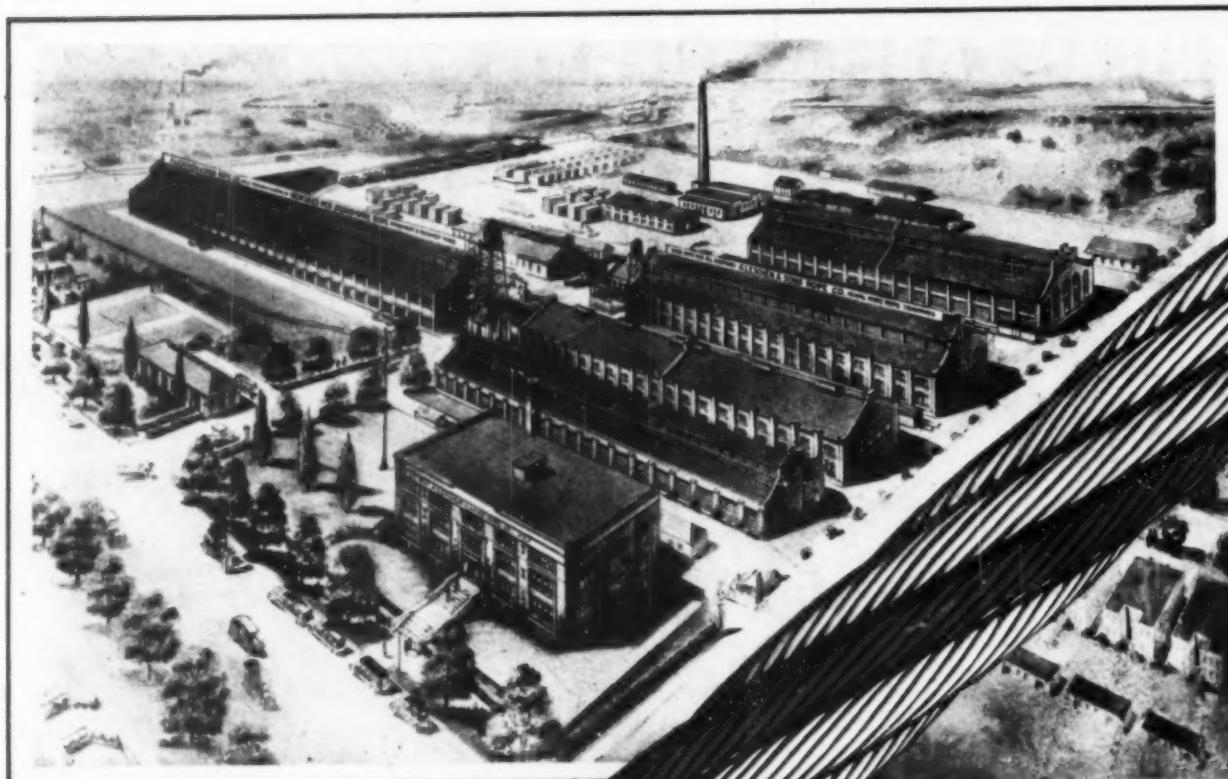
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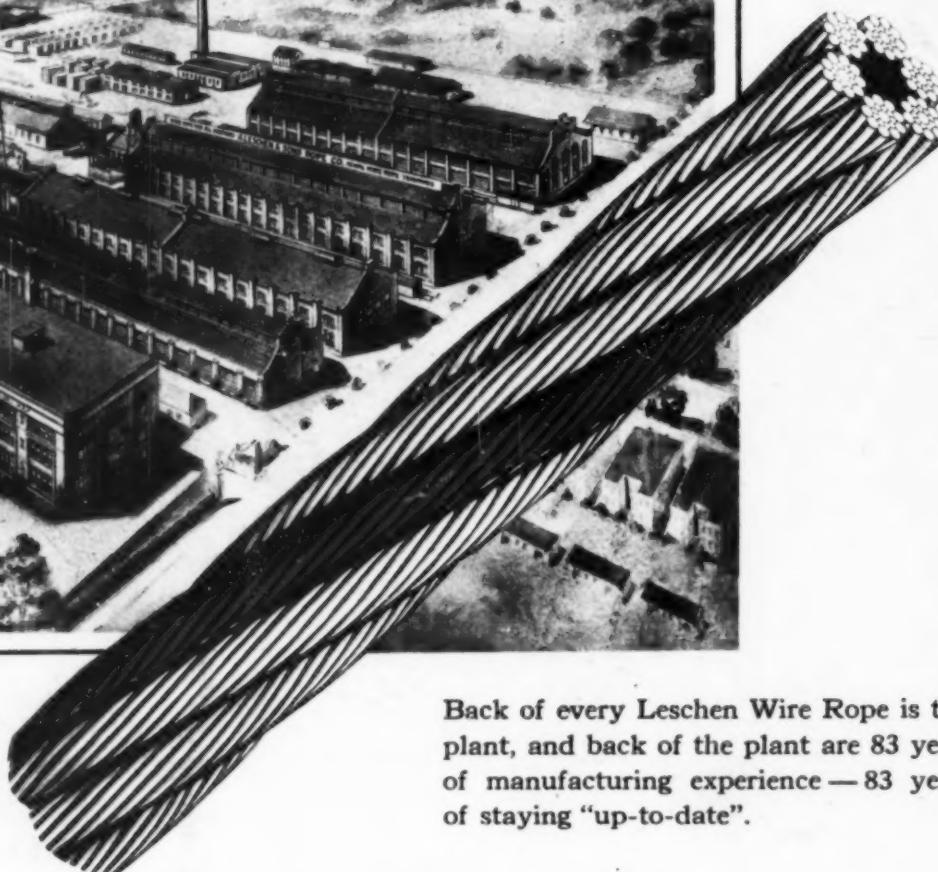
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